METAL FINISHING

PREPARATION, ELECTROPLATING, COATING

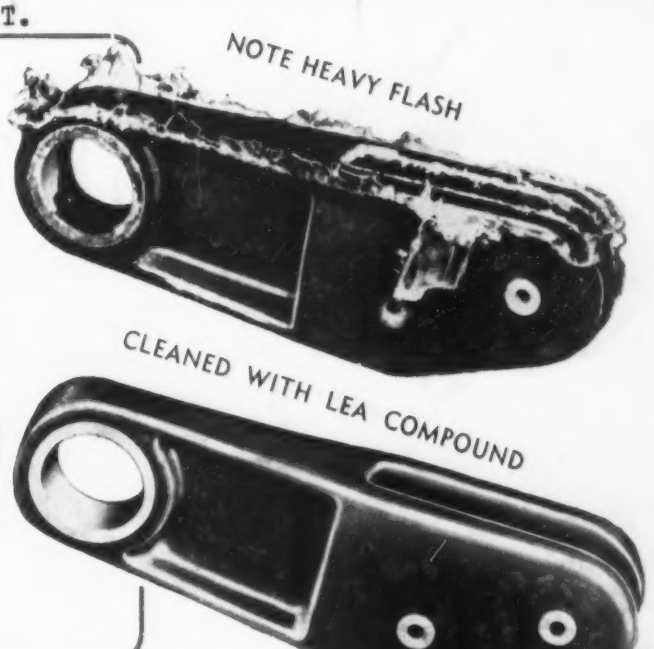
PUBLISHED FOR THIRTY-SEVEN YEARS AS METAL INDUSTRY

COPYRIGHT DEPOSIT.

One Operation with LEA Compound *Eliminates Hand Filing*

reports

AMERICAN INSULATOR CORPORATION*



Molding an idler crank in rag-filled Bakelite left a heavy flash at the parting lines — and dumped a stiff production problem right in the lap of American Insulator Corporation, New Freedom, Penna.

Formerly, each part was hand-filed to remove flash and the resulting seam was buffed. It was a slow process, so they searched for and found a better and a faster way.

"The laborious process was eliminated by the use of a single LEA COMPOUND operation. LEA COMPOUND is used on a soft cloth buff 7" in diameter, running at a speed of 2350 R.P.M. This change to LEA COMPOUND has permitted a definite SAVING IN COST and TIME, and PRODUCES A BETTER FINISHED APPEARANCE than that possible by the hand-filing method."

To meet other war production needs, LEA engineers have developed many new techniques. For example, by the use of various types of cone-shaped bobs, operating on a tapered spindle, counter-sunk holes of varying diameters can be burred effectively without filling threads or holes with foreign material.

Write LEA in detail about your burring, polishing, or buffing problem. Invite a LEA engineer to call for a consultation. He will gladly help you solve your problem.

* Photographs and data courtesy American Insulator Corporation

THE LEA MANUFACTURING CO.

WATERBURY 86, CONNECTICUT

Burring, Buffing and Polishing . . . Specialists in the Development of Production Methods and Compositions

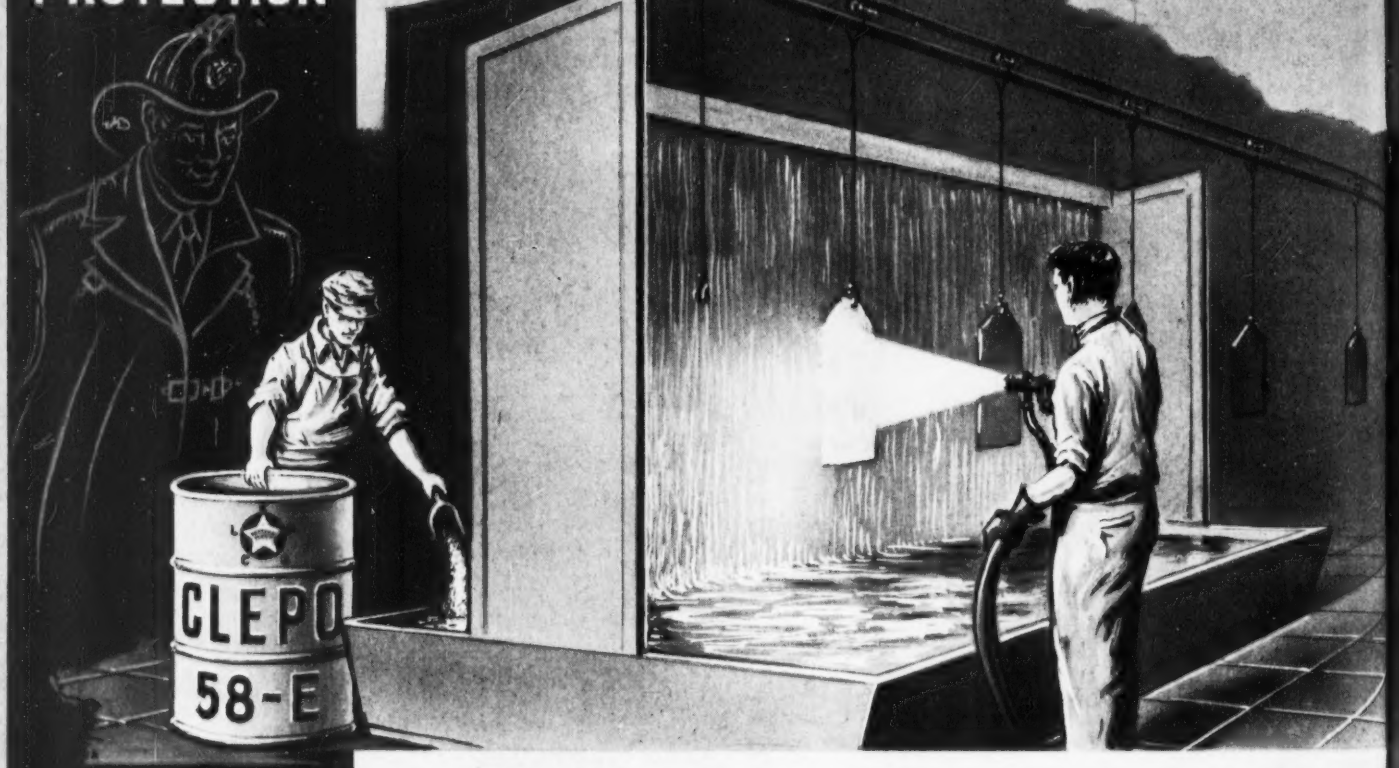
10-LM-2

OCT 21 1943

FOR SAFETY, ECONOMY, AND PROTECTION USE

CLEPO STRIPPER "58-E"

CLEPO INVISIBLE FIRE PROTECTION



1. Clepo 58-E Stripper solution precipitates enamels, lacquers and paints on top of reservoir solution - for easy separation.
2. Clepo 58-E Stripper solution chemically treats this residue to make it non-inflammable. Residue will not burn when subjected to open flame.
3. Clepo 58-E Stripper solution renders spraying equipment impervious to rust. Eliminates maintenance problem.
4. Paint or enamel pigments can be reclaimed from residue if desired.

FREDERICK GUMM CHEMICAL COMPANY, INC.
538-542 FOREST ST., KEARNY, N. J.

EXPERIENCED CHEMISTS READY TO SERVE YOU

The key technical men of the Enthone technical staff are all university trained and factory experienced. Each has served for more than ten years in the plating room, supervising plating developments . . . learning and doing. They are not "book" chemists but engineers who know how to apply science to practice.

The outstanding Enthone technical developments are just a harbinger of even greater things to come. Since the founding of the company in 1930 these have been: Platers Solvent Cleaner, a pioneer emulsifiable cleaner; Baked Enamel Stripper, for removing synthetic enamels from all metals without attack; Lacquer Retarder, a product to eliminate lacquer blushing in warm, humid weather; Acid Addition Agent, a pioneer surface active material for better pickling; Super Wet Strength Filter Paper, a thin paper with amazingly high wet strength for filtering both acid and alkaline solutions; Flux No. 20, a soldering flux that does not cause corrosion on steel; Ebonol "A", a process for plating upon aluminum and for blackening aluminum; Ebonol "C", a new development for the direct, low-temperature blackening of copper and its alloys to produce a stable, wear resisting black coating; Ebonol "S", a one-bath process for blackening steel and cast iron; Ebonol "Z" for blackening zinc plate and zinc alloys and for preparing zinc surfaces for organic finishing. These are just a few and there are many more to come . . . .

If you have a plating or finishing problem, these technical men with over 30 years of combined practical experience can help you. Their experience is in back of each Enthone product. Write and tell us your problem.

DR. WALTER R. MEYER

Technical Director

B. S. (chemistry) and Ph.D. (metallurgy) Yale University

Chemist, Sargent & Co. two years; electrochemist and metallurgist, General Electric Co. seven years; Editor "Metal Industry" and "Metal Finishing" four years. Member A. E. S., Electrochemical Society, A. S. M., Faraday Society, D. B. G., A. I. M. E., Electrodepositors Technical Society, Sigma Xi; Instructor, lecturer, A. E. S. Medallist, author.

CLARENCE C. HELMLE, Ch.E.

Chemical Engineer from Rensselaer Polytechnic Institute; served 12 years as chemist, electrochemist, plating engineer and metallurgist with General Electric Co. Teacher of chemistry, electrochemistry, and metallurgy; Second Supreme Vice President, American Electroplaters' Society; author and lecturer.

DERICK S. HARTSHORN, JR. Ch.E.

Chemical Engineer from University of North Carolina; served seven years as chemist and plating engineer with Westinghouse; member Electrochemical Society and A. E. S.; author, lecturer.

ENTHONE

THE ENTHONE CO.

442 ELM STREET NEW HAVEN 2, CONNECTICUT

This FREE Instruction Manual Describes How to SPEED-UP Anodic DEGREASING of STEEL!

OAKITE
COMPOSITION
No. 90
A NEW, SCIENTIFICALLY DEVELOPED MATERIAL FOR ANODIC DEGREASING OF STEEL AND COPPER
Oakite Composition No. 90 is a product of the Research Laboratories of
OAKITE PRODUCTS, INC., 32 THAMES ST., NEW YORK 6

PLATING superintendents, technical supervisors, shop foremen and other executives are invited to send for this NEW, specially prepared, 16-page illustrated manual. In it you will find practical data for SPEEDING-UP anodic degreasing or reverse current cleaning of steel and copper aircraft, tank, communication and ordnance war supply items before cadmium, chromium, bright zinc, bright nickel and similar electroplating and finishing operations.

Based on Successful Experience of War Plants the Nation Over!

This NEW Oakite instruction manual explains how a recently developed material . . . Oakite Composition No. 90 . . . QUICKLY and THOROUGHLY removes insoluble smut, grease, oil, buffing and polishing compounds, etc., giving you the CHEMICALLY CLEAN, smut-free surfaces you want for stepped-up production schedules. The manual also describes how 10 typical war plants are increasing output and securing better finishes by using FAST-WORKING Oakite Composition No. 90.

YOUR COPY Now Ready For Mailing!

This fact-filled manual is FREE on request. Write for YOUR copy TO-DAY . . . there's no obligation, of course!

Wartime Applications of Oakite Composition No. 90 In the Manufacture of:
Aircraft Parts
Shells
Cartridge Boxes
Bomb & Bomb Fuzes
Bomb Sight Lenses
Radio Housings
Steel Shot
and many other vital war supplies!
Electric Switch Boxes
Electric Light Covers
Gun Mechanisms
Machine Tool Parts
Truck Parts
Army Food Containers and Kitchen Equipment
Reports by Superintendents of plating departments, Technical Supervisors, Shop Foremen and others, who are using Oakite Composition No. 90 in the production of a wide variety of war materiel, indicate that this material is a marked advance in anodic degreasing. Most important advantages noted are improved surface preparation of work, unusual time reductions, conservation of manual effort, elimination of pre-cleaning operations, longer solution life and fewer rejects.
A few typical examples illustrating how Oakite Composition No. 90 is being successfully used in wartime production are given on the following pages. These cases demonstrate the fast, uniform results that have been achieved in securing chemically clean surfaces before all types of plating and finishing operations.
Cleaning Aircraft Parts Prior to Various Plating Operations
The Plating Department of a large Midwestern aircraft manufacturer found that their electrocleaning tank, which handled a large volume of work, had to be dumped every day causing a production loss of two to three hours and reheated. Introduction of Oakite Composition No. 90 effectively checked this loss providing a solution that lasted six times longer than
though the
Page 10
RECESSED AREAS
TRAPPED SOLUTION
SOLUTION LEVEL
compound pigments, metallic particles and shop dirt, is the most difficult deposit to remove and the one most frequently found on steel surfaces the fast-working, thorough smut-removing action of Oakite Composition No. 90 is of prime importance.
7. Pre-Cleaning Operations Eliminated
Because of the unique properties described above, this material eliminates, in most cases, the need for pre-soaking, hand wiping, brushing, swabbing and similar cleaning operations. This advantage naturally tends to speed-up rate of production while the specially designed degreasing action of the material assures the chemically clean surfaces required for subsequent finishes.
8. Longer Solution Life
Initial and reserve alkalinity components, plus properties of life of solution. cleaning cost.
Page 7

TYPICAL DATA-PACKED PAGES

Manufactured only by
OAKITE PRODUCTS, INC., 18 Thames Street, NEW YORK 6, N. Y.
Technical Service Representatives in All Principal Cities of the United States and Canada

OAKITE CLEANING

MATERIALS . . METHODS . . SERVICE

FOR EVERY CLEANING REQUIREMENT

METAL FINISHING is Published monthly by The Metal Industry Publishing Company, 11 West 42nd Street, New York, N. Y., U. S. A.
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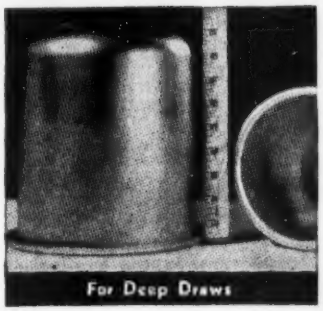
Volume 41, Number 10, October, 1943. Two Dollars Per Year.

SEYMOUR

. . . NON-FERROUS ALLOYS SINCE 1878 . . .

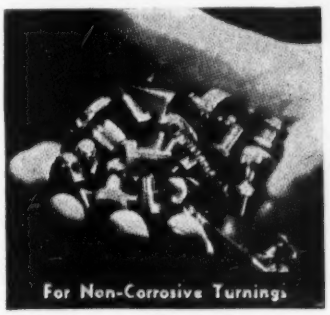
NICKEL SILVER


For Deep Draws

Seymour Nickel Silver is an alloy of copper, nickel and zinc. Silvery white all through, it is the perfect base for silver, nickel and chromium plating. A fine, even grain makes it ideal for ornamental etched articles such as tags, novelties, etc.

A Silvery White Plating Base

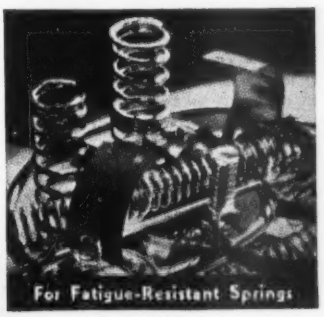
It takes any hardness from dead soft up gradually to spring temper. It is especially suitable for extra deep draws and difficult spinning. When leaded for free cutting, it is widely used for non-corrodible screw machine products.


For Non-Corrosive Turnings

Seymour Nickel Silver is made in sheet, wire and rod. The rod comes in round, square, angular and fancy shapes—also leaded for free milling, turning, threading, etc. In numerous standard grades, and in special grades to order.

PHOSPHOR BRONZE

Seymour Phosphor Bronze is an alloy of copper, tin and phosphorus. It is highly resilient to corrosion, abrasion, friction and fatigue. Practically indifferent to thermal change, it is dependable material for small bearings.


For Fatigue-Resistant Springs

For Long-life Switch Contacts

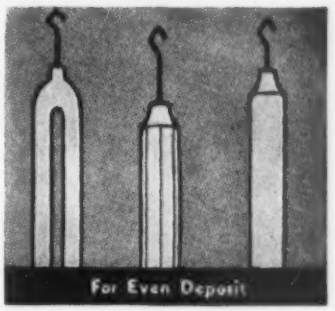
Because of its great toughness and fatigue resistance, it is ideal for springs (such as in electric snap switches) that must function indefinitely. In several standard grades of sheet, wire and rod. Special grades to order.

WELDING RODS

For Dependable Welds

Seymour Phosphor Bronze Welding Rods, available in Grades A, C and D, for both gas and electric welding, are the product of a long experience in alloying bronzes. Clean, easy melting, they produce welds of high tensile strength.

NICKEL ANODES


For Even Deposit

99% + Rolled Depolarized—A very fine, homogeneous, even-grained virtually pure nickel anode. Corrodes in hot or cold solutions with minimum metallic loss. Forms practically no sludge. Especially suitable for baths having a pH above 4.5 electrometric.

99% + Cast Oxide Depolarized—Almost entirely pure nickel. Suitable for most cold nickel baths, but especially those having a high pH. Corrodes evenly under most ordinary shop conditions.

99% + Cast Carbon—A pure nickel anode with carbon content adjusted for smooth, uniform corrosion without special controls. Available, however, with carbon content to meet any specifications. Adaptable for general shop work requiring cold baths.

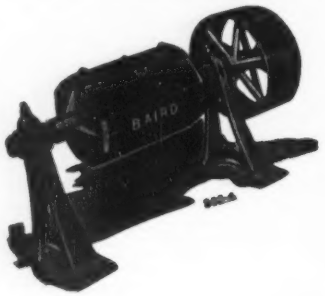
95-97% Sand Cast—Corrodes readily in solutions low in nickel or weak in salts—therefore suitable for cold, high pH low current density plating solutions. Uniform corrosion throughout the life of this anode is obtained by an even distribution of the carbon content. A 90-92 Sand Cast Seymour Nickel Anode is also available.

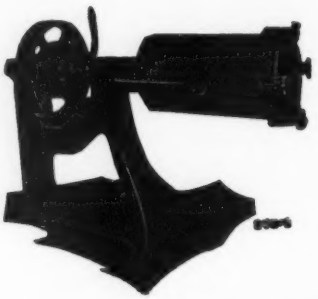
"Seycast"—An improved type of 99% + cast anode of very high efficiency designed primarily for Bright Nickel baths, but works perfectly in any hot Watts bath having a pH of 4.5 electrometric or lower. Corrodes evenly with practically no loose nickel formation, due to long, interlocking grains radiating from a common center. Especially suitable for high current densities.

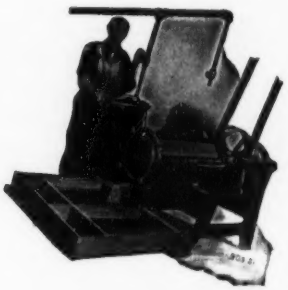
Bright Nickel—A hot organic type process free from promoter metal, stable and easily controlled. Produces brilliant deposits from a standard hot nickel bath without the usual coloring or buffing. Excellent throwing power. Wide operating conditions. Free from wetting out agents.

OTHER ANODES—Seymour Anodes in all shapes to meet rigid specifications are also available in copper, brass, bronze and zinc. The copper used is electrolytic. The zinc is always the best grade obtainable.

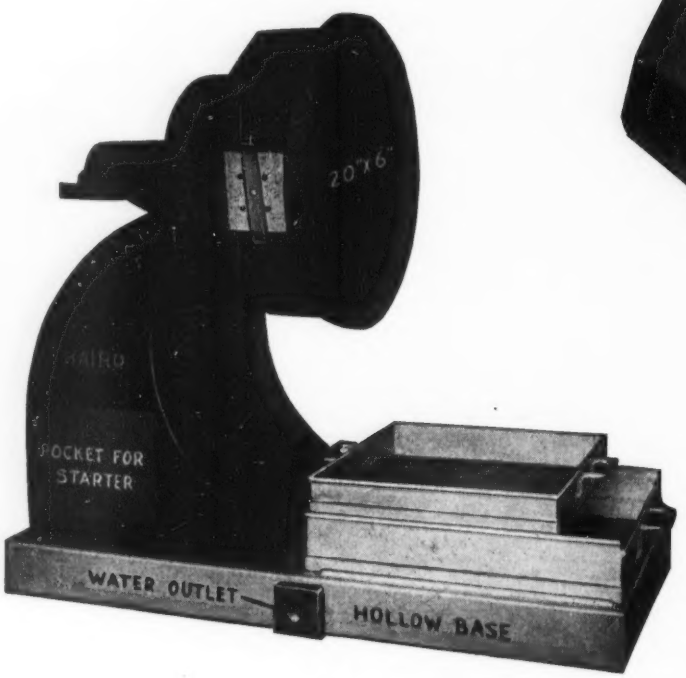
THE SEYMOUR MANUFACTURING COMPANY, 70 FRANKLIN ST., SEYMOUR, CONN.

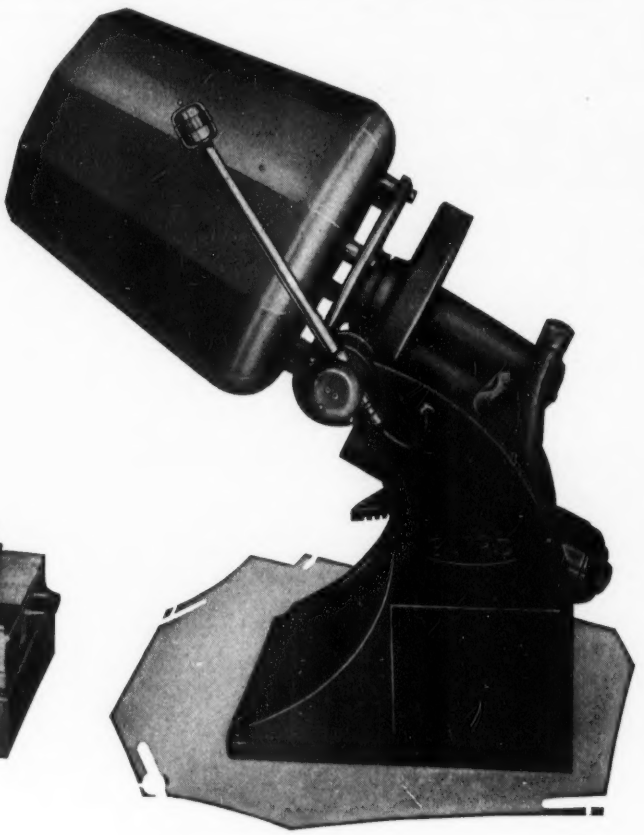






HORIZONTAL BARRELS **TILTING BALL BURNISHING BARRELS**





This shows a High and Narrow Type of Barrel mounted on "Baird" Model D. or Pedestal Type Motor driven Oblique Tilting Tumbler.

As shown the barrel was lined for use for burnishing with hardened steel balls.

These barrels may be of any suitable material depending on the job. Cast iron or fabricated steel unlined or lined with rubber etc. for rolling in abrasives.

Made in 20" dia. x 6" for No. 1 Tumbler
Made in 24" dia. x 8" for No. 2 Tumbler

This shows the side of a No. 1 BAIRD Model D. Single Oblique Tilting Tumbler with a No. 22 Sheet Steel Polygonal Barrel and with an Automatic Electrical Tilting Device.

This device AFFORDS GREATEST SAFETY — LEAST LABOR — LEAST FLOOR SPACE—LEAST AMOUNT OF DISTANCE TO MOVE WORK in USING the tumbling barrels. SAVES TIME AND FLOOR SPACE.

When tumbling questions come up "ASK BAIRD ABOUT IT"

AUTOMATIC MACHINERY BAIRD STRATFORD CONNECTICUT, U.S.A.

THE BAIRD MACHINE COMPANY

STRATFORD 9, CONNECTICUT

Since 1846 specializing in high production machinery for articles of wire and for ribbon metal. Also machines to turn, bore, etc., castings, forgings, etc., up to 10½" diameter.

Will your black oxidized and oil-dipped steel parts stand up for

375 HOURS

under the A.S.T.M. 20% Salt Spray test? They will with BLAXITE.

BLAXITE

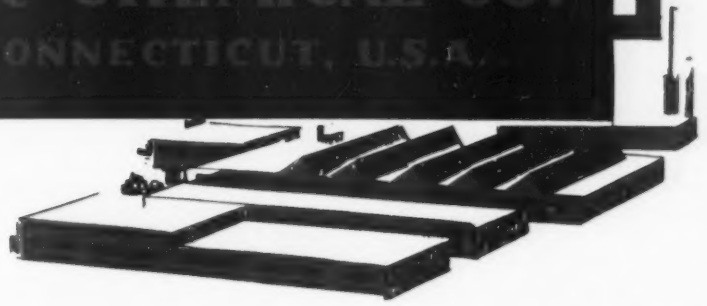
Call in a BLAXITE Man* For Low-cost Black Finishing

Are your costs on black steel oxidizing as low as they should be? Let one of our engineers estimate on BLAXITE processing and equipment for your plant. Send us samples and specifications and we'll quote promptly on quantity production. Cost-comparisons usually result in a saving with BLAXITE.

With BLAXITE your steel and iron parts color to a deep rich black in either dull finish or high gloss. Highly resistant to rust through final dip in "RUST-CHEX". This special oil compound leaves an invisible rust-resisting film. Send samples for free processing with BLAXITE and get full details and figures for your work.

**Factory representatives located in larger cities from coast to coast.*

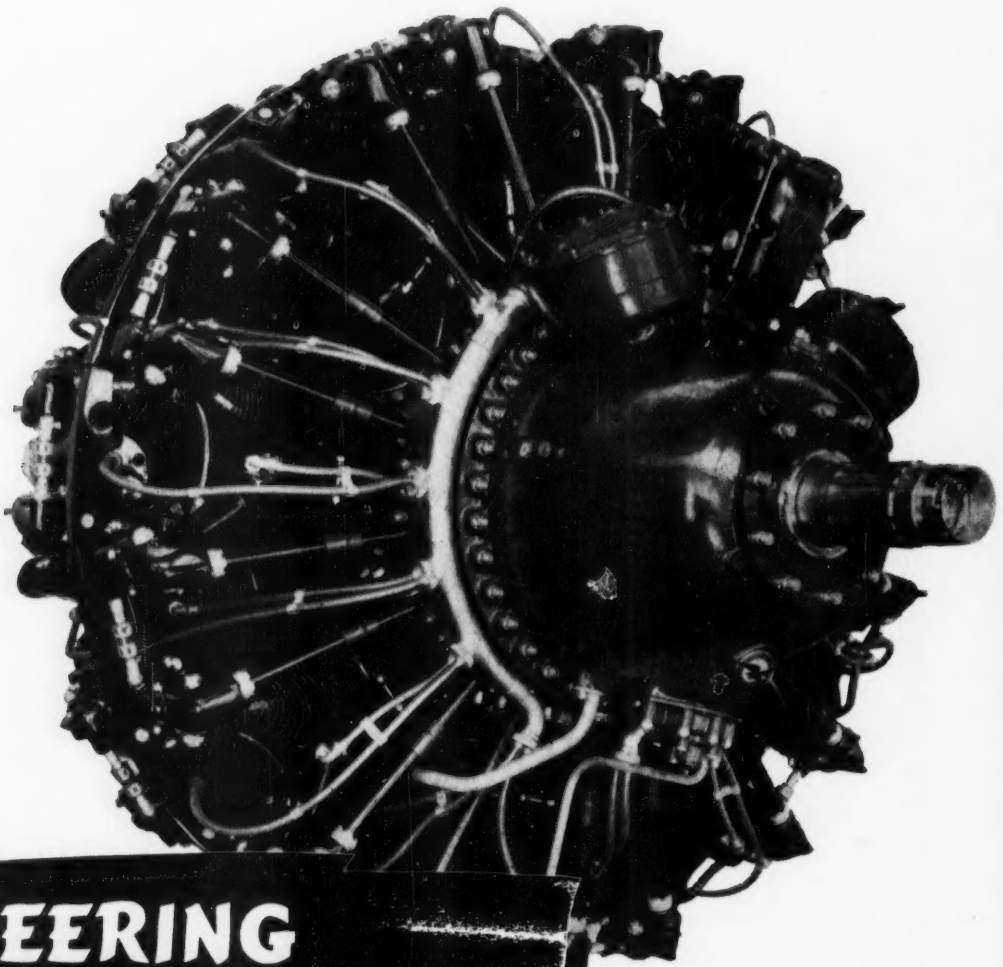
The TOBLER CHEMICAL CO.
PORTLAND, CONNECTICUT, U.S.A.



Send for free

BLAXITE PORTFOLIO OF PROCEDURE

It explains Blaxite processing in detail. No charge.



ENGINEERING AUTHORITIES SPECIFY DU-LITE for Engines

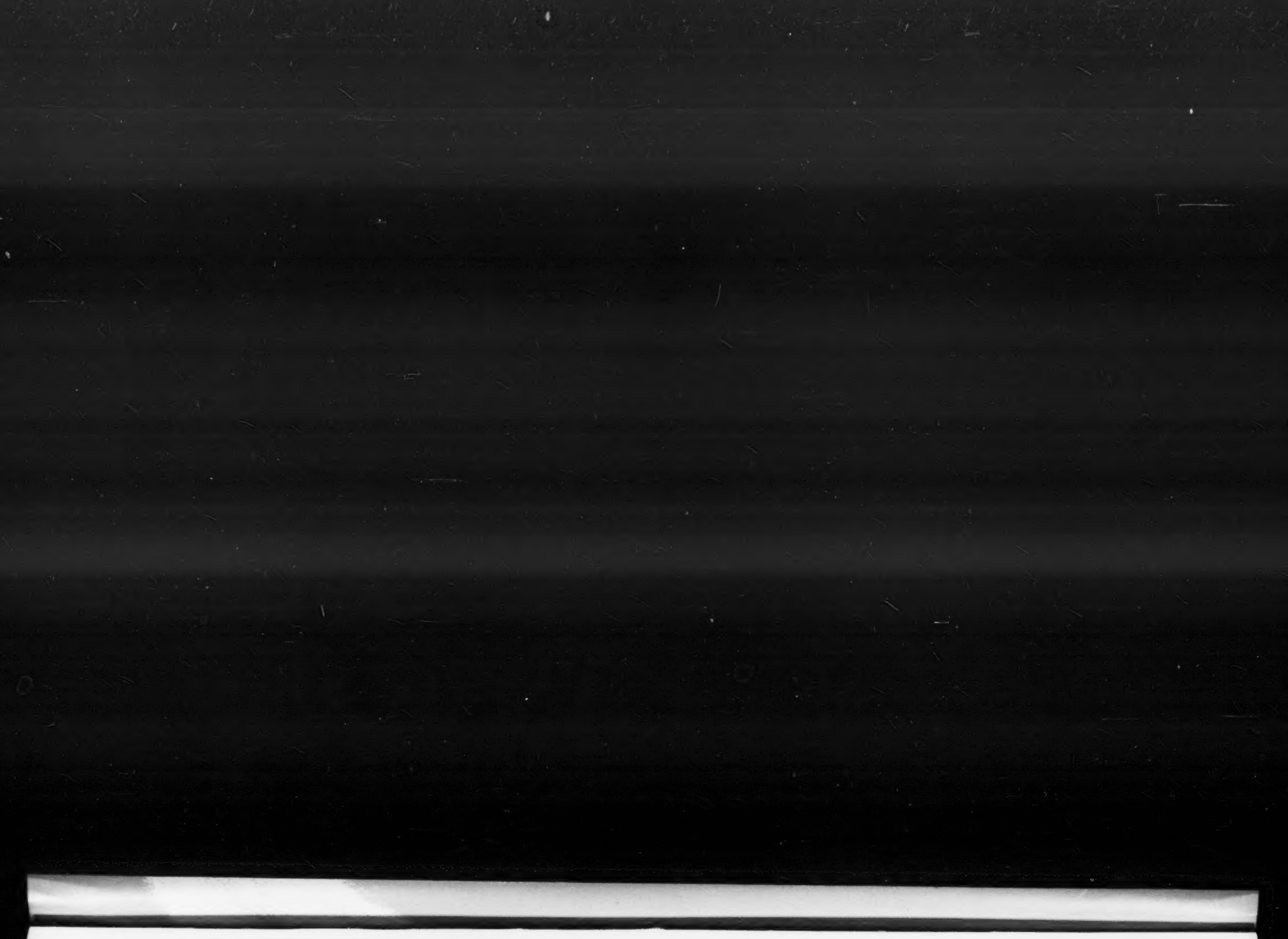
DU-LITE is used by leading airplane engine manufacturers. They have found that performance is actually improved by the use of Du-Lite finished parts. This is due to the fact that the deep penetration of Du-Lite provides maximum aid to lubrication.

The microscopic sharp corners, found on even highly polished bearing surfaces, are smoothed by the Du-Lite processing. The layer of black oxide produced absorbs and holds oil. This results in a lower coefficient of friction and prevents galling of closely fitted bearings during breaking-in periods.

Du-Lite is used on other engine parts as a protection. Here again the deep penetration is important for it provides maximum rust resistance.

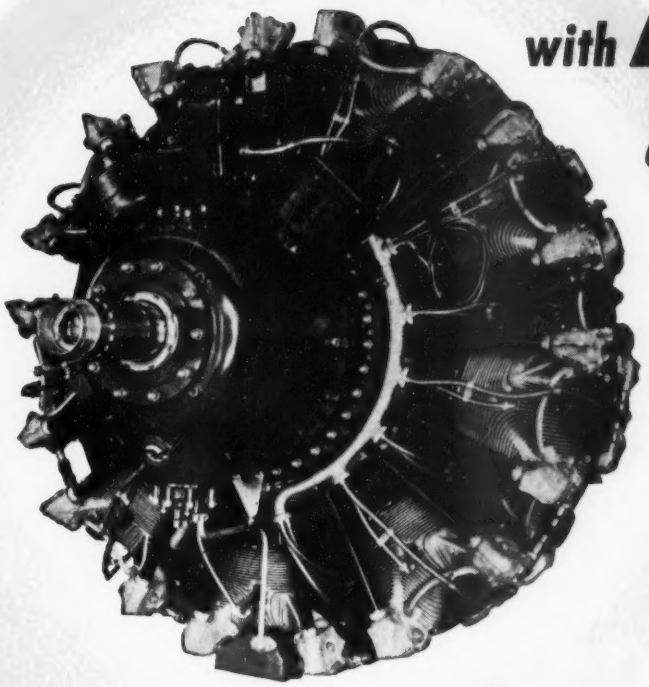
Du-Lite is the choice of engineering authorities because of these qualities plus its economy and the ease with which large volumes of work can be handled efficiently in a minimum of space. Du-Lite Engineers are located in the chief industrial centers and are at your service for consultation and advice. Your inquiries will have prompt attention.

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONNECTICUT



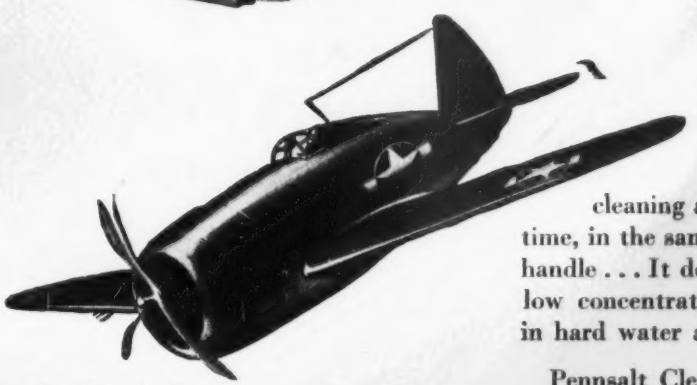
PRATT & WHITNEY AIRCRAFT

cleans engine parts



with PENNSALT CLEANER K-7

Reg. U. S. Pat. Off.



in the Bullard-Dunn Process

An important metal cleaning job in this plant is the removal of scale and oil from Pratt & Whitney aircraft engine parts. Pennsalt Cleaner K-7 was demonstrated in the Bullard-Dunn Process with highly satisfactory results, at a concentration of only 10 ounces per gallon.

Here are the outstanding advantages of this Pennsalt Cleaner: It does *not* leave a film . . . Both cleaning and defilming are done in minimum time, in the same tank . . . Pennsalt K-7 is easy to handle . . . It does not fume . . . It can be used at low concentrations . . . And it is suitable for use in hard water areas.

Pennsalt Cleaner K-7 was designed specifically for the cleaning and defilming operations in the Bullard-Dunn Process and has been thoroughly tested and approved by The Bullard Company.

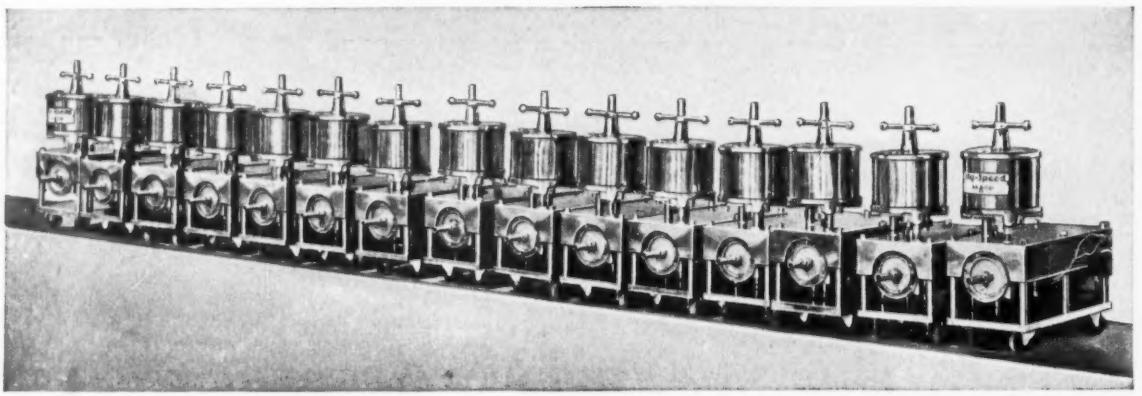
Pennsalt Cleaner K-7 is one of a complete line of Pennsalt Cleaners available for all types of metal cleaning. If you have a wartime metal cleaning job, by all means make use of the wide experience of our technicians. No obligation. Simply write fully about your problem to our Pennsalt Cleaner Division, Dept. MF.

PENNSYLVANIA SALT MANUFACTURING COMPANY

Chemicals

1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

New York • Chicago • St. Louis • Pittsburgh • Minneapolis • Wyandotte • Tacoma

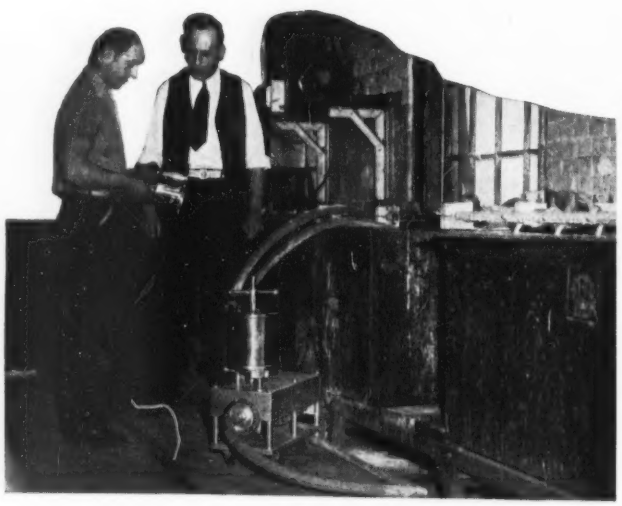


THESE
ALSOP "SEALED DISC" FILTERS

ARE READY FOR SHIPMENT TO A LARGE PLATING DEPARTMENT

These popular and efficient plating solution filters have been selected because they are easy and inexpensive to operate, do such a fine job of completely filtering out all dirt, sludge and impurities, and keep solutions clean all the time.

This modern practice of keeping plating solutions clean at all times, means finer finishes, fewer rejects and increased production.



Showing how one of the above filters will be doing its job.

PERFECT FILTRATION OF OILS

We have developed an unusual new filter for all kinds of oils. Transformer, Hydraulic, Turbine, Fuel, Diesel, Machine cutting and Cooling oils all perfectly filtered for use again by our inexpensive

PAK-FILTER

Somewhere in your plant there is a use for this filter. Write us for complete details.

ALSOP ENGINEERING CORP.

30 Bright Street **Milldale, Conn.**

TODAY'S TREASURE

Salvage WORN TOOLS - DIES - GAGES

USING PROVEN RACKOTE INSULATIONS

Speed and more speed in war production has been the chief cause of a large accumulation of off-size precision parts and the discarding of costly worn Tools, Dies and Gages. Now, while the demand in current production is greatest, these off-size and discarded parts, can be converted, easily and profitably, into "Good-as-New" condition by the use of proven RACKOTE STOP-OFF LACQUERS together with proper electroplating. Factory stocks insure prompt delivery.

WYANDOTTE ★ PAINT PRODUCTS CO.

WYANDOTTE PAINT PRODUCTS CO.

RACKOTE DIVISION - WYANDOTTE, MICHIGAN

DISTRIBUTORS AND WAREHOUSE STOCKS IN PRINCIPAL UNITED STATES AND CANADIAN CITI

ZINC PLATING

TYPE X POROKLEEN PENETROL

Working in co-operation with industry, Turco research chemists and field engineers have solved the plating problems of hundreds of war production plants. The data thus compiled has been summarized in a comprehensive bulletin.

"CYANIDE ZINC AND BRIGHT ZINC PLATING"

Turco offers this bulletin as a free service to industry. It describes materials, equipment and the practicable technique required in most plating operations where it is necessary to replace cadmium plating with zinc plating.

A limited edition of this free bulletin is now available to engineering and production executives. Use the coupon below or make request on your letterhead.

A consultation with your nearest Turco Field Service Man, who will prescribe the material and equipment you need, merely awaits your request.

TURCO PRODUCTS, INC.

SPECIALIZED INDUSTRIAL CHEMICAL COMPOUNDS

MAIN OFFICE & FACTORY: 6135 SO. CENTRAL AVE., LOS ANGELES 54
CHICAGO OFFICE & FACTORY: 4856 SO. HALSTED ST., CHICAGO 9
SERVICE MEN AND WAREHOUSE STOCKS IN ALL PRINCIPAL CITIES

TURCO PRODUCTS, INC., 6135 S. Central Ave., Los Angeles 54

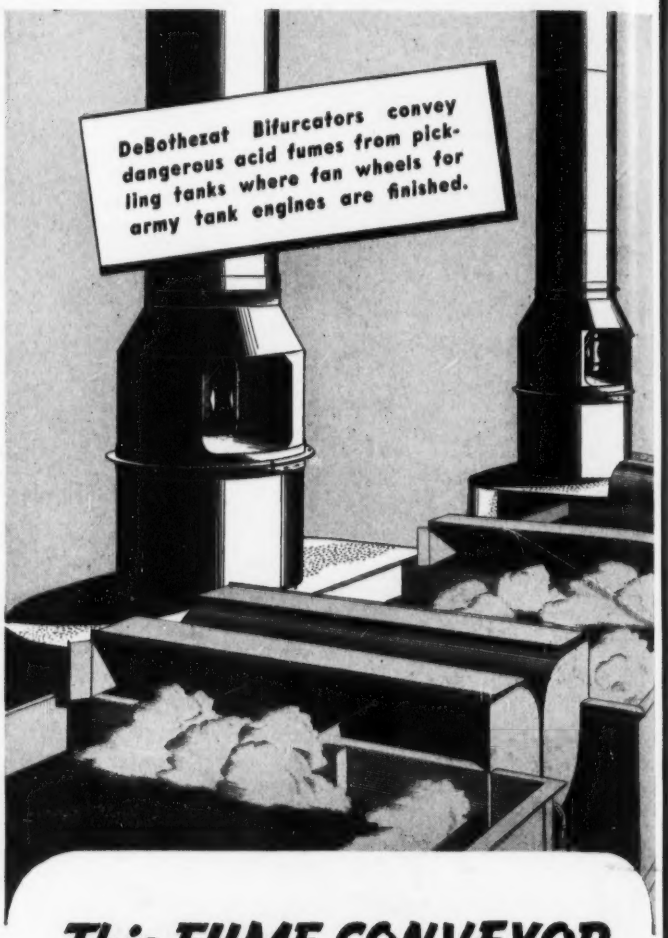
Please send free bulletin, "CYANIDE ZINC & BRIGHT ZINC PLATING"

Name ..... *Firm* .....

Title .....

Address .....

27-103 *On Your Letterhead, Please*


DeBothezat Bifurcators convey dangerous acid fumes from pickling tanks where fan wheels for army tank engines are finished.

This FUME CONVEYOR INSTALLS IN THE DUCT

YOU CAN INSTALL DeBothezat Bifurcators in any position from horizontal to vertical . . . and *right in the duct!* This feature *eliminates* elbows, bends and supporting platforms. Bifurcators are supported like any length of ordinary duct work. Extreme flexibility makes installation simple and inexpensive.

MOTOR ISOLATED FROM FUMES in a through-ventilated chamber. Motor is easily accessible for inspection and servicing.

MOTOR PROTECTED against burning out by non-overloading power characteristic of the DeBothezat Axial-Flow fan.

SIZES of Bifurcators range from 18" to 48" in a wide range of capacities.

ARMY E NAVY

Send for Interesting FREE Bifurcator Book

DeBothezat

VENTILATING EQUIPMENT
Division of
AMERICAN MACHINE AND METALS, INC., EAST MOLINE, ILLINOIS

More THAN A POUND

In the Metal Finishing field, the name UDYLITE stands for better, more successful Cadmium Plating. . . . Since 1919 Udylite's famous research laboratories and staff of metal finishing engineers have pioneered the use of Cadmium—Developing new and better methods of application—Disseminating this information and improvements to the trade. . . . The benefit of Udylite's years of experience is yours for the asking. When you buy Cadmium Anodes, plating equipment or supplies from Udylite you receive "More than a pound". The "know-how" behind each Udylite product is a *plus value* you cannot find elsewhere. . . . If you are not already a Udylite customer we invite you to enjoy the advantages of Udylite's complete metal finishing service.

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BOYS
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ZINC PLATING PROCESSES

THE proper plating solution can be easily installed and used in standard plating equipment. Procedures have been simplified so that every experienced plater can easily get either dull or bright zinc plate on a wide variety of work. With the right process and the high quality of Du Pont materials, every plater can get consistently good results.

A competent group of technical men with many years of experience in all types of plating will be glad to discuss your plating problems and help in the selection and application of processes and materials. Electroplating Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington, Delaware.

DU PONT
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(Formerly called Du Pont Bright Zinc). For production of bright deposits from solutions made up with standard chemicals.

DUCTILE ZINC

Matt white deposits, suitable for deep drawing and sharp bending.

STRAIGHT CYANIDE ZINC

Easily controlled plating solutions for production of fine-grained, rust-proof deposits.

"ZIN-O-LYTE"

Bright Zinc deposits directly from baths made up with prepared salts.

ZINC PLATING CHEMICALS

"Zin-O-Lyte" Salts
"Zin-O-Lyte" Brightener
"Zin-O-Lyte" Anodes
"Durobrite" Anodes
Zinc Cyanide
"Cyanegg"—Sodium Cyanide
"RH 309"—Bright Zinc Brightener
"Purozinc" Anodes

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

"So solly— hon. fifth columnist dirt commit hara-kiri"

Foreign matter that must be eliminated prior to finishing operations *is* a fifth columnist, a saboteur of our war effort.

Wyandotte Metal Cleaners spell a new kind of hara-kiri, or elimination, for grease, oil and film. With a product compounded to meet every challenge of metal cleaning and degreasing, Wyandotte may well be prepared to supply your most exacting needs.

There is a specialized Wyandotte cleaner for every metal cleaning problem and for use in all types of equipment. Wyandotte's cleaning role, especially in armaments and airplane parts manufacturing, is a *vital* one today.

Why not call in your nearest Wyandotte Representative? His skill and experience, time and advice, are *yours* to command.

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SERVICE REPRESENTATIVES IN 88 CITIES

WYANDOTTE CHEMICALS CORPORATION
J. B. FORD DIVISION • WYANDOTTE, MICHIGAN

• Wyandotte Chemicals Corporation consolidates the resources and facilities of Michigan Alkali Company and The J. B. Ford Company to better serve the nation's war and post-war needs.

NATIONAL METAL CONGRESS *and* WAR CONFERENCE DISPLAY

"BASE OF OPERATIONS" for the Metal Industry

Chicago PALMER HOUSE **October 18 thru 22**

America's metal industry will move its "base of operations" to Chicago's Palmer House the week of October 18 to take full advantage of the 25th annual National Metal Congress and War Conference Display.

Devoted to increased production of war products, to conservation of materials, and to postwar planning, this year's Congress and Conference Display will bring vital new developments and ideas to the attention of thousands of war production executives and engineers in the metal industry.

More than a hundred technical lectures will be presented by the four cooperating societies. Leaders in the metal industry and government will participate in the Special War Production and Conservation Sessions held each day by the American Society for Metals, sponsor of the event.

Hundreds of manufacturers will participate in the War Conference Display to be held in the Palmer House itself. These companies will have their engineers, their literature, light equipment and parts at these Conference Display rooms to help metal men solve their problems and increase production.

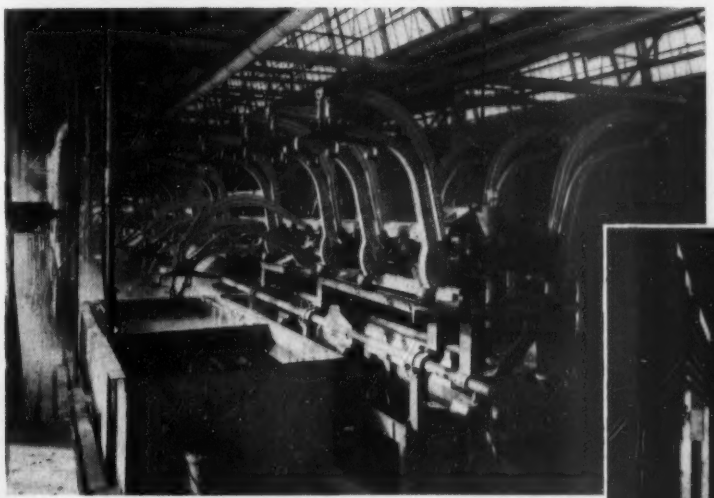
For complete information on these War Conference Displays — write or wire the American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio. Phone Endicott 1910.

NATIONAL METAL CONGRESS AND WAR CONFERENCE DISPLAY

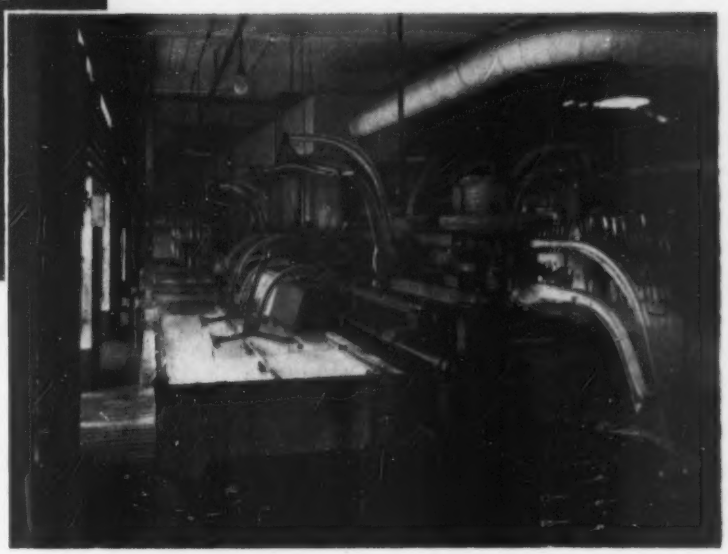
Under the direction of the American Society for Metals, in cooperation with the American Welding Society, the Wire Association, and the Institute of Metals and Iron and Steel divisions of the American Institute of Mining and Metallurgical Engineers.

STEVENS AUTOMATIC PLATING EQUIPMENT

FULL and SEMI



for ANODIZING ★ PLATING
DEGREASING ★ CLEANING
PICKLING ★ GALVANIZING
ANY PROCESS ★ ANY PRODUCT



Prior to Pearl Harbor, many plants began to quickly and economically convert their Stevens Equipment from peace- to war-time production.

We still have a war to win, and, if we can be of assistance to you in helping to speed the day of complete victory, please call upon us.

If and when you contemplate reconverting your present equipment, or, the addition of new equipment for peace-time production, we shall be glad to discuss your plans with you—study your operations and make our suggestions and recommendations.

A request on your business letterhead will bring a copy of our new booklet to you. Ask for Catalog PEC

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BUFFING COMPOSITIONS • METAL POLISHERS AND ELECTROPLATERS SUPPLIES-EQUIPMENT

YOU WOULDN'T WASH YOUR FACE IN MUDDY WATER

—but you're doing the same kind of thing when you use a plating solution that's only partly clean.

The bath may not look muddy, but may still contain harmful impurities that reveal themselves only by spoiled plating.

DARCO S-51 stands guard against spots, dullness, poor adhesion and similar "headaches" by removing invisible impurities before they can do harm at the plated surface. Rejects and lost time are greatly reduced.

With all these time-saving, money-saving advantages, DARCO S-51 is low in cost. A little over a dime a week buys enough DARCO to keep 100 gallons of solution in a state of first-class cleanliness.

Write for a sample—or order a supply from your jobber today.

The article, "Physical Removal of Impurities from Plating Solutions" discusses continuous filtration in detail. Write for a copy.

DARCO—Reg. U. S. Pat. Off.

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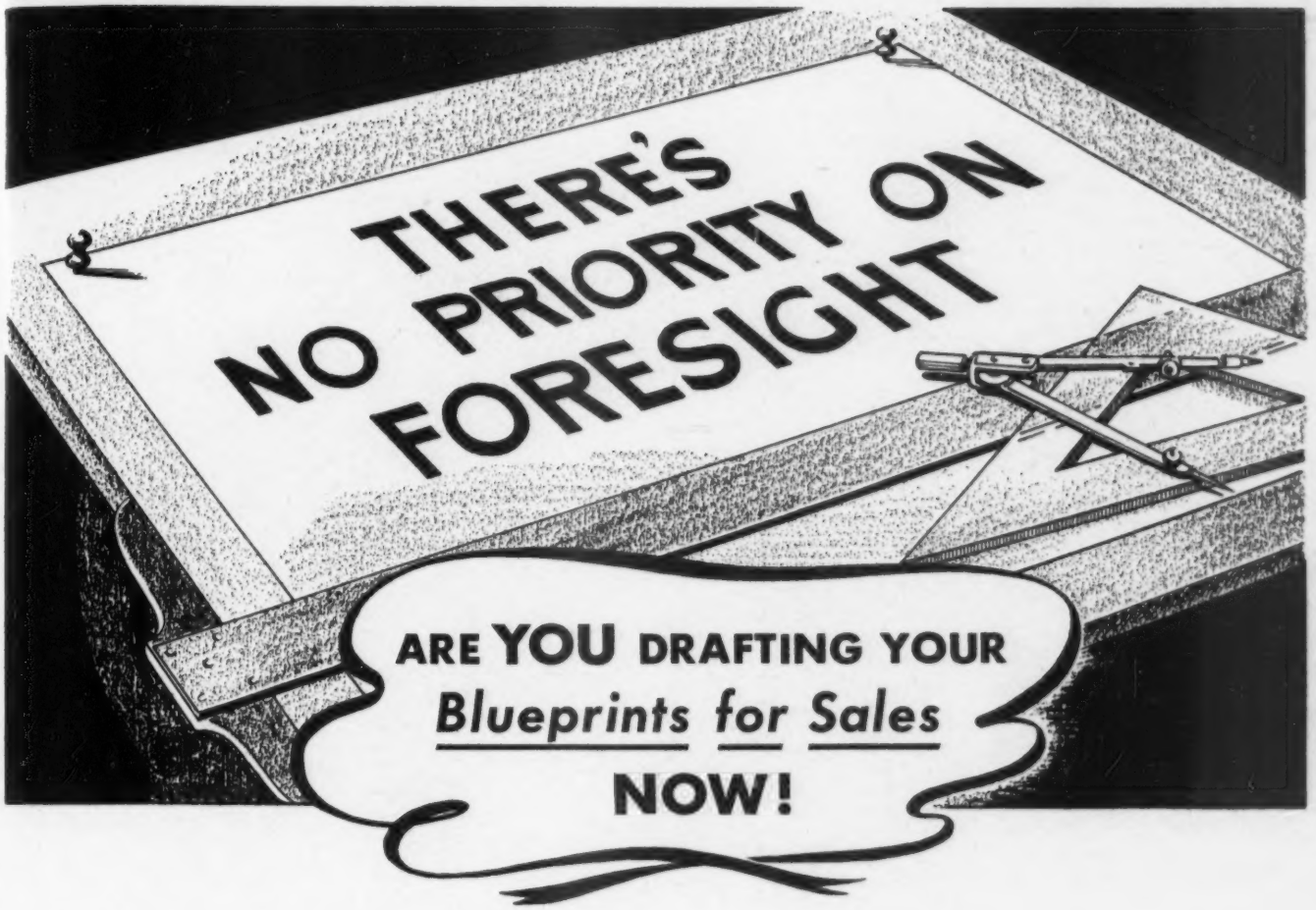

ON THE FACE of it, it might appear that the strict war measures imposed on the Metal Finishing industry would act as a complete throttle on the progress of postwar metal finishing development for the duration. In actual point of fact, current research and the development of better finishes for metals are being spurred more rapidly than ever before.

So today, while it's true that the stringent regulation of all metal finishing materials by priority has limited postwar product finishing development to the blueprint stage, the driving spirit which adapted prewar product finishes to actual war uses will in turn apply newly developed war material finishes to postwar products.

Thus, this same driving spirit is finding outlet in the Blueprints for Sales being drafted by just those manufacturers who, while they work round-the-clock to help win the war, are just as determined they shall not lose their share of the peace, for their share of postwar markets must guarantee steady after-the-war employment for the thousands who today are winning this war on the war and home fronts.

McAleer has been privileged to help many of these manufacturers solve the varied and complex problems involved in applying metal finishing methods to war purposes. These same companies, we feel, will turn naturally to McAleer for the answer to their postwar product finishing needs.

If you are extending the ways in which metal finishing is serving our armed forces—keep up the good work! Yet, remember—*there's no priority on foresight!* With the winning of this war—another battle no less important at the time, will just begin—your battle for existence in the postwar markets of tomorrow. McAleer men, methods and materials stand ready to serve you, today and tomorrow.

McAleer MANUFACTURING CO.

Manufacturers of Quality Controlled Finishing Materials

ROCHESTER, MICHIGAN

Calling all Hands

FOR ON-THE-JOB SAFETY AGAINST SKIN IRRITATIONS

MSA FEND

INDUSTRIAL PROTECTIVE CREAMS AND LOTIONS

Prevention of irritated skin conditions (known as industrial dermatitis) so widely prevalent among workers today, usually can be achieved simply and effectively by the use of proved FEND barrier skin protection. In the complete line of FEND Industrial Creams and Lotions you'll find the *right* product for protection against the specific skin irritants encountered in your operations — medically-correct, easy to apply, non-clogging to the pores, non-sticky, quickly removed with mild soap and water at shift's end.

Write today for the comprehensive FEND Brochure—thoroughly detailed—filled with facts you can use—containing the FEND Application Chart listing scores of irritants encountered in industry, and the FEND type providing adequate protection against each irritation.

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NEED BRUSHES in a HURRY?

Good Delivery

ON STANDARD - SIZES and STYLES

There is no need to tie up vital plating equipment because of delay in securing standard types and sizes of Metal-Graphite brushes. We are prepared to give good delivery on Keystone Metal-Graphite grades with molded-in shunts for low voltage generator applications. When in need of replacement brushes, send us machine data together with style and size of brush required. Your inquiry will be given immediate attention and prompt shipment made on brushes for standard types of plating generators.

KEYSTONE CARBON CO., INC.

Manufacturers of Precision Moulded Products

1935 STATE ST., SAINT MARYS. PENNA.

WHY

Buy just a Temperature Control?

When this . . .

Electronic TANK CONTROLLER

"The Automatic Tank Watchman"

—provides leveling—leak detection—overflow warning—and temperature control. All of these and many other features are combined in one instrument which can be obtained at no greater cost than what you would pay for a good temperature control alone.

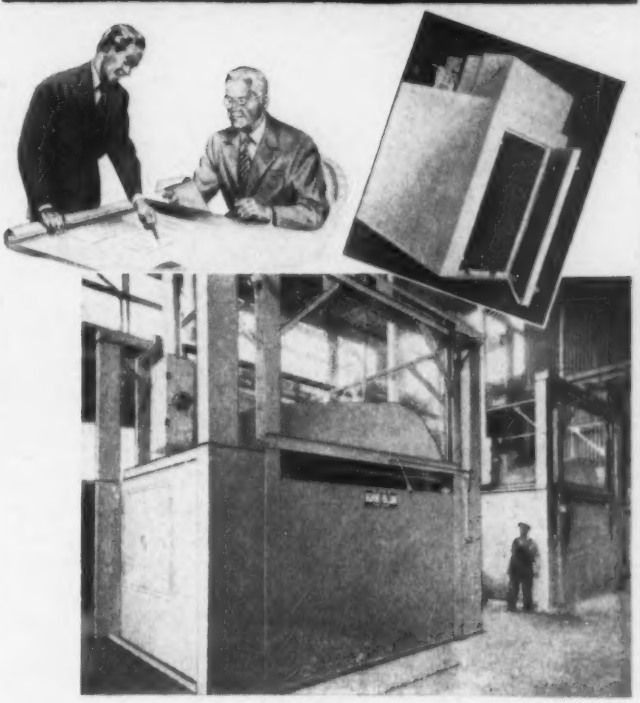
Install one of these models on your plating tanks and start immediately to save manpower—material and unnecessary waste.

Made in 3 reasonably priced models—Write for booklet giving full details.

PLATING PROCESSES CORP.
HOLYOKE • MASSACHUSETTS

Efficient Industrial Ovens

. . . come only from ENGINEERING "KNOW-HOW"



Top illustration is a steam heated re-circulating type armature baking oven built for General Electric. This oven operates at 302 degrees F. Automatically controlled by means of air operated controller.

Bottom illustration is a direct gas-fired oven for core and mold drying and stress-relieving, built for Aluminum Industries Inc. Equipped with vertical, electrically operated, safety doors. Maximum operating temperature is 550 degrees F. Automatically controlled by air operated modulating recorders.

The Kirk & Blum Engineering Staff, backed by 36 years of experience, is thoroughly grounded in the efficient design and installation of equipment involved in product finishing operations.

In such operations, industrial ovens—necessitated by modern high-speed production—perform an important role. And here again the expert knowledge and scientific approach of Kirk & Blum Engineers has come to the fore, providing highly efficient, economical ovens for many leading manufacturing plants throughout the nation.

Our engineers plan, design, and erect complete oven installations of any type—continuous conveyor drying and baking ovens, core baking ovens, etc. These systems are guaranteed by Kirk & Blum to speed production . . . reduce fuel and labor costs . . . save floor space . . . promote maximum safety.

Don't take chances with a "hit-or-miss" oven installation Get the unbiased counsel and scientific planning of experts—Kirk & Blum Engineers. Write to The Kirk & Blum Manufacturing Co., 2874 Spring Grove Ave., Cincinnati, Ohio, for Booklet "Industrial Ovens".

KIRK AND BLUM
AN ORGANIZATION OF ENGINEERS AND MECHANICS

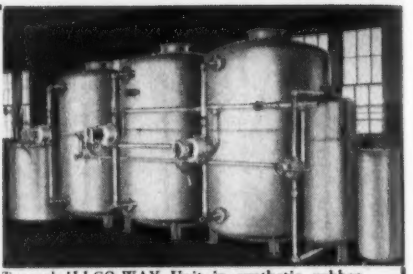
BUY MORE WAR BONDS—NOW

Pure Water FOR PLATING

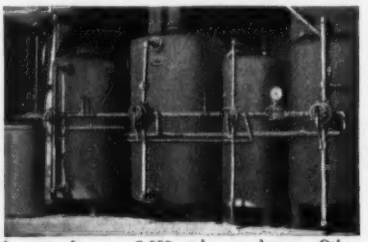
at a fraction of former costs!

De-ionized water (comparable to distilled water, but at a fraction of its cost) in plating solutions and in pre-rinse tanks eliminates the troubles due to mineral salts in water supply. Ion-exchange resins can also be used to reclaim precious metals now being washed away in solution. Pioneers in the manufacture of De-ionizing equipment, ILLCO has been called on to supply pure water in a number of plating departments and users are enthusiastic about results. . . . Without *heat*, without fuel, ILLCO-WAY De-ionizing units are daily producing pure water to meet exacting industrial and technical standards in leading U. S. plants.

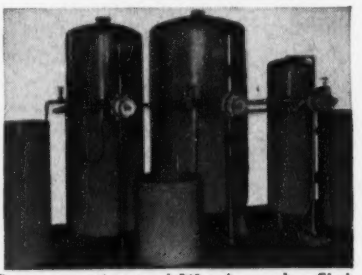
NEW CHEMICAL METHOD REPLACES DISTILLED WATER! This modern, economical method is based on ion-exchange, and uses Amberlite resins. Cost of the treated water is remarkably low—only a few cents per thousand gallons. . . . Learn how ILLCO-WAY equipment can speed production, help cut costs in *your* plant! Write for literature today!



Typical ILLCO-WAY Unit in synthetic rubber plant—4,500 gals. of De-ionized water an hour.



Aircraft factory—2,000 gals. an hour. Other units have permissible flow of from 100 to 50,000 gals. per hr.



Pharmaceutical plant, 1,700 gals. per hr. Similar equipment used for plating and anodizing.

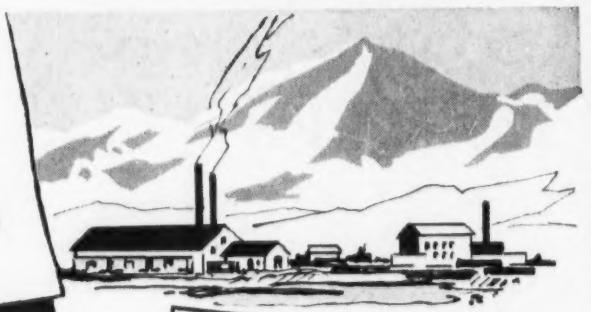
TESTED IN THE LABORATORY * ILLCO-WAY * PROVED IN THE FIELD

ILLINOIS WATER TREATMENT CO.

Water Treatment Engineers

856 CEDAR STREET
ROCKFORD • ILLINOIS

A PUMICE TO MEET EVERY NEED



Not until Valencia — the standard of American Pumice— was discovered at Grants, New Mexico, was it thought that a domestic pumice could match the quality of imported Italian Pumice. This inexhaustible deposit at Grants is true pumice stone and not a volcanic ash. It is physically and chemically equal in every respect to the now unobtainable Italian Pumice. • The Valencia plant's output of grades for every need is rigidly under control for particle size, purity, weight and color.

Check this table comparing Valencia with the highest grade of imported Italian Pumice. See for yourself that Valencia is truly the standard of American Pumice.

	American Pulverized Per Cent	Italian Select Per Cent
Silica	72.90	73.24
Alumina	11.28	10.61
Iron Oxide	.86	1.57
Titanium Oxide	.06	.10
Calcium Oxide	.80	1.10
Magnesium Oxide	.36	.40
Soda	3.64	3.03
Potash	4.38	5.58
Sulphuric Anhydride	.03	.05
Loss on ignition	5.20	4.04

Distributors of THE PUMICE CORPORATION of AMERICA
GRANTS NEW MEXICO

WHITTAKER, CLARK & DANIELS, INC.

260 WEST BROADWAY • NEW YORK CITY

Warehouses: Detroit, Michigan and South Kearny, N. J.

CONSERVING
Copper and Bronze

● Millions of these small parts, formerly made of copper, bronze and other critical metals, are now being made of steel and lead-plated in our plant to give dependable protection against corrosion under the most severe tests. We offer our service to you.

STEEL PROTECTION & CHEMICAL CO. INC.

★ ★ MOORESVILLE, INDIANA ★ ★

Prolong the Life of your Plating Solutions

SPARKLER HORIZONTAL PLATE FILTERS

will enable you to use your solutions over and over again, keeping them free of solids. Solutions will apply better and allow you to circulate as rapidly as your current density demands and eliminate bumpy finishes.

LONGER CYCLES • FASTER CLEANING • USE ANY FILTER MEDIA

PORTABLE • ECONOMICAL

Visit the Sparkler Exhibit at the National Metal Congress, Palmer House, Chicago, October 18 - 22, Room 962-W.

SPARKLER MANUFACTURING CO.

285 Lake Street MUNDELEIN, ILLINOIS

Capacities: 50 to 10,000 G.P.H.

AXELSON *insists on* QUALITY

Excerpt from a recent issue of Axelson CONTACT, published by Axelson Manufacturing Company, pioneer producer of oil well pumping equipment, engine lathes, gages, and aircraft parts, of Los Angeles, California.

Send for free copy of the new Pentrate book

HEATBATH CORPORATION

Springfield, Massachusetts

"PENTRATE"

A CHEMICAL PROCESS WHICH HELPS IN THE MAINTENANCE OF AXELSON QUALITY

Quality has been an Axelson tradition for fifty years. During that time many new ideas have been developed and put into use in order to assure and maintain quality throughout every Axelson manufacturing step.

One of the many departments installed to make possible the production of better equipment for better service is the "Pentrate" department. This division is devoted entirely to the process involved in giving various metal parts a non-plated, rust resistant black satin-like finish that will stand up against many forms of corrosion.

The Pentrate department is in the capable hands of Joe Palma, whose wide background includes a close association with industrial chemistry for many years.

The Pentrate method of product finishing is a development of the Heatbath Corporation of Springfield, Mass., and constitutes a concentrated processing bath which applies, through chemical action, a penetrating, durable satin-black surface to products made of steel.

Pentrate is not a plating process, and does not, in itself, create corrosion resistance. Rather, it is a process by which certain chemical salts are caused to penetrate the outer surface of the metal. The rust and corrosion resistant factors are brought about by the fact that oil or other lubricants will adhere far more readily to a Pentrated surface than to a non-processed surface. Once a part has been through the Pentrate process it can be oiled and, when wiped dry (not chemically washed), can be successfully subjected to many of the standard tests for rust and corrosion resistance. Pentrate is not a superficial "cover-up" coating — it is an actual penetration. Consequently the appearance of a Pentrated surface depends upon the finish of the metal before processing. Spots, flaws, grinding checks, etc., will still show if present on the surface to be processed.

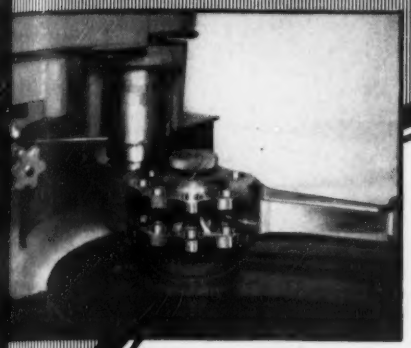
Laboratory tests and the results shown by parts in daily service prove that because of the friction-reducing feature of being more capable of retaining a lubricant, Pentrated surfaces will last longer and give more satisfactory service.

Cutting-tool efficiency has also been greatly increased when the tool is Pentrate-processed because the sleek finish thus provided goes a long toward stepping up the discharge of chips, thereby helping to eliminate "loading" the tool.

Many products formerly finished by such methods as lacquering, oxidizing, or saltpeter bluing can be more satisfactorily handled by the Pentrate process. Pentrate, too, looks better, will not chip, peel, crack, or rub off, and in most cases is very inexpensive in its application.

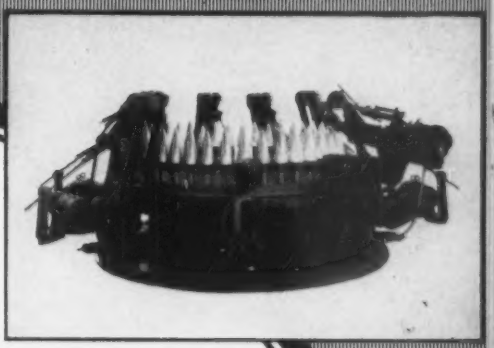
Master Chemist Joe Palma personally watches every phase of Pentrate processing. Strict attention to proven formulas is Joe's secret of success in this department.

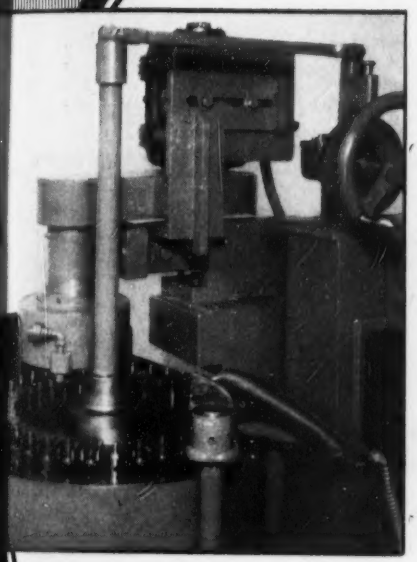
Solving the Man-Power Shortage in POLISHING..BUFFING.. WIRE BRUSHING..BURRING



Special Acme Machine for polishing engine parts.

Special Acme Machine with 8 belt heads — for polishing tapered cylindrical parts. Multiplies daily production, with greatly reduced man-power.



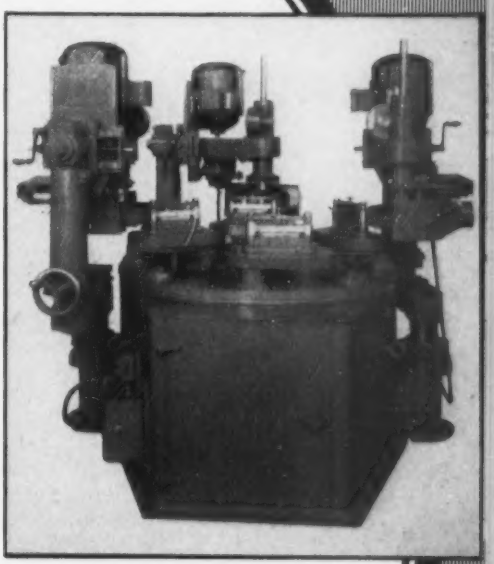


Keep Production Up

BY USING

ACME AUTOMATICS

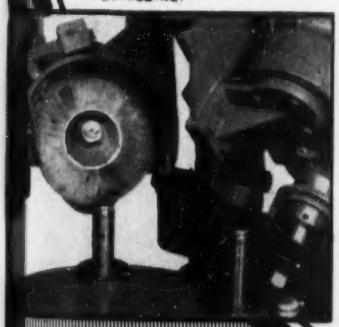
And Spreading Your Man-Power!



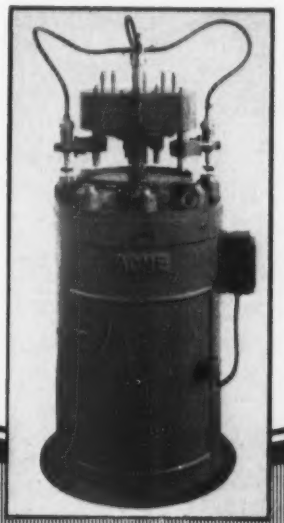
Special Acme Machine for grinding small mechanical parts—2000 per hour. Automatic wheel feed. Automatic diamond dresser. Automatic unloading.

Special Acme Machine for blending the radius in washers—1200 to 1500 operations per hour.

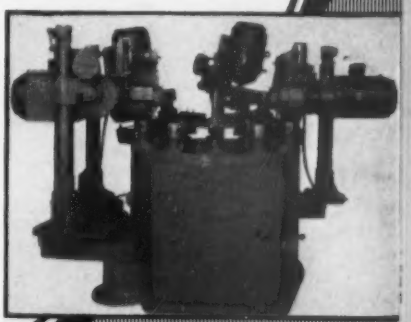
Special Acme Machine for polishing and oiling aircraft parts.



Acme Rotary Machine for polishing, buffing and wire-brushing. Big savings in man hours.



Special Acme Machine for finishing pistons. Constructed to finish valve recess and avoid sluff marks.



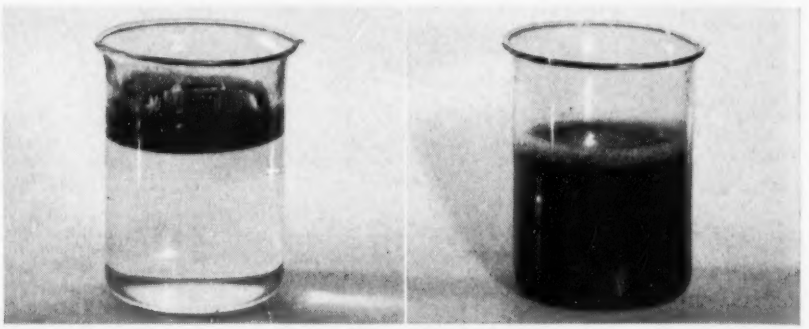
ACME Manufacturing Co.

1642 HOWARD ST. • DETROIT, MICH.

Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR OVER 25 YEARS

1 SAFETY

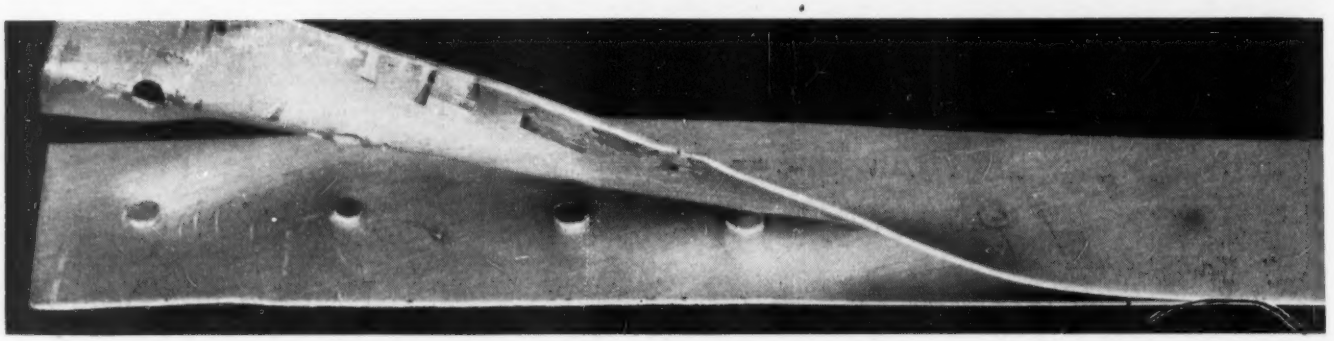
2 POWERFUL WETTING AND PENETRATING ACTION



MAKE THIS SIMPLE TEST: Add some light oil to raw acid in a beaker. Note how the oil floats on top . . . proof that the acid has little effect on the oil.

Now add the same oil to a solution of D-C No. 1. Note how the oil "disappears" in the solution. Here is proof that D-C No. 1 wets and penetrates oil, removing it quickly and completely from the work.

3 MAXIMUM EFFICIENCY IN WELDING



The above illustration shows two strips of aluminum that have first been cleaned with Diversey Aluminum Cleaner, next treated with Diversey D-C No. 1, then spot welded together. When the strips are pulled apart with pliers, the "spots" are torn from one strip and remain welded to the other. The "weld spots" form a stronger bond than the metal itself . . . proof that Diversey D-C No. 1, by safely removing oxides, assures maximum welding efficiency.

HELP WANTED?

Here's one "help wanted" problem that's easily solved . . . even in these days of man-power shortages. If it's a problem in metal cleaning and working . . . the Diversey D-Man is always on deck to lend a helping hand. Backed by a Research Laboratory that has spent 18 years developing special purpose products, the Diversey D-Man can often show you ways to step-up production that require less man-power.

DIVERSEY D-MAN

See Our Exhibit at the National Metal Congress, Palmer House, Room 818

You get all three with

DIVERSEY D-C No. 1

A non-toxic, non-fuming, dry powdered product, Diversey D-C No. 1 has been developed to replace harsh, corrosive, and dangerous acids, thus eliminating the possibility of injury to workers. Superior wetting and penetrating action quickly and uniformly removes oxide and anodized film, thereby assuring maximum efficiency in welding. At the same time D-C No. 1 is gentle to aluminum surfaces.

OTHER TYPICAL USES { **Removing anodized or oxidized film . . . removing discoloration . . . removing scale and rust . . . preparation of metal surfaces prior to repainting.**

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THE DIVERSEY CORPORATION

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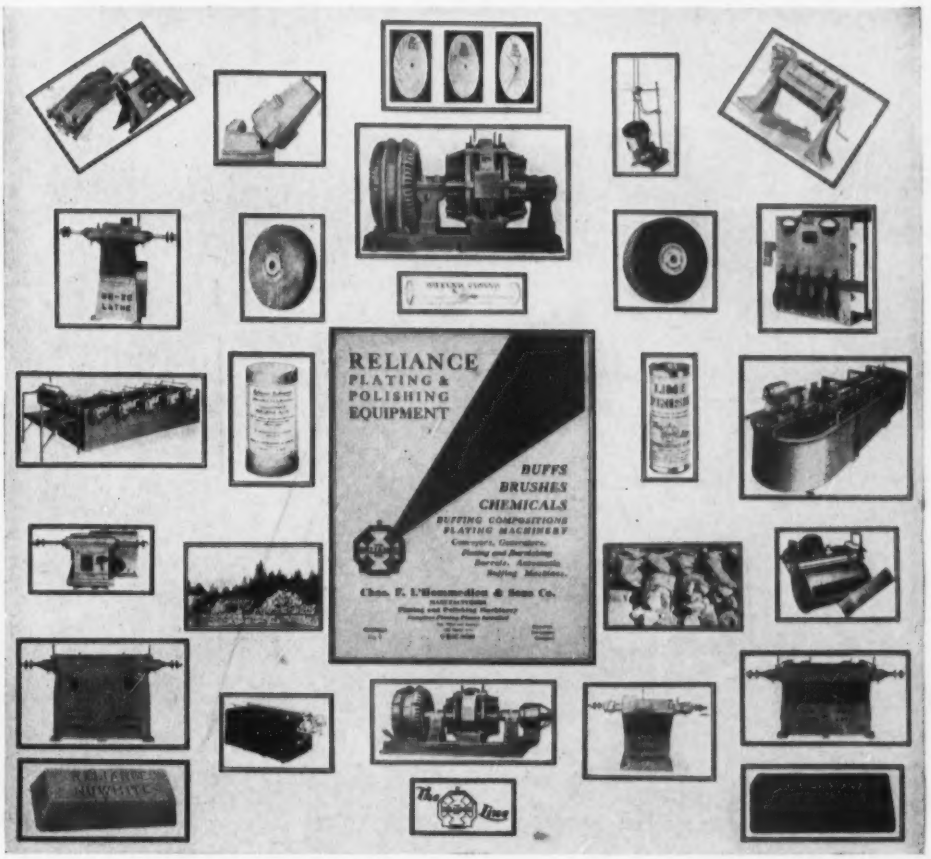
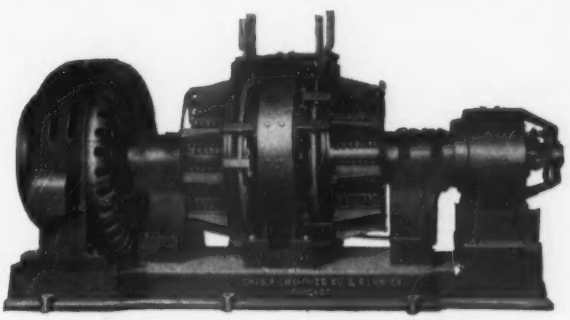


EVERYTHING FOR PLATING AND POLISHING



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This Lead Plating booklet furnishes you with practical plating information which you can use. We will gladly send you this free book. Write for it . . . now.

HARSHAW

THE HARSHAW CHEMICAL CO.
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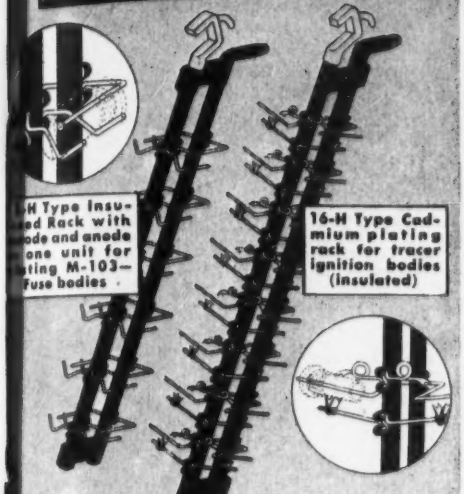
BELKE PLATING RACKS

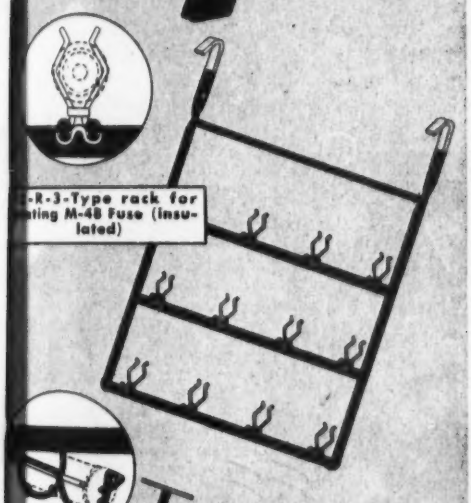
New — Wonderful Synthetic Insulation

FOR ANODIZING

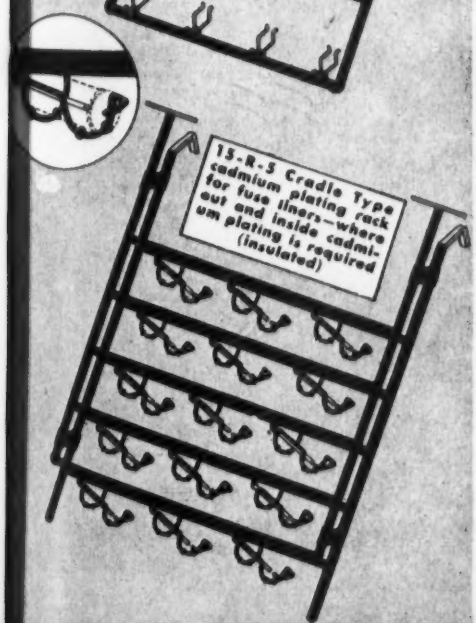


-H Type Insu-ed Rack with ode and anode one unit for ting M-103— Fuse bodies

16-H Type Cadmium plating rack for tracer ignition bodies (insulated)

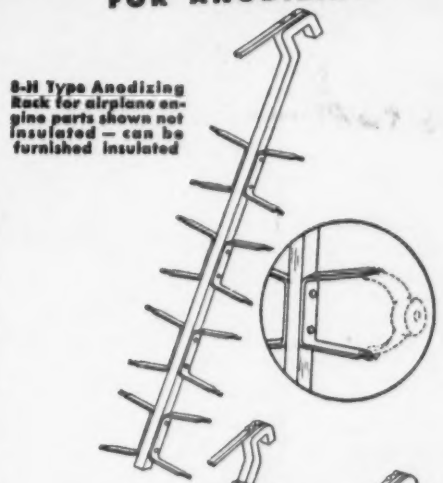


-R-3-Type rack for ting M-48 Fuse (insulated)

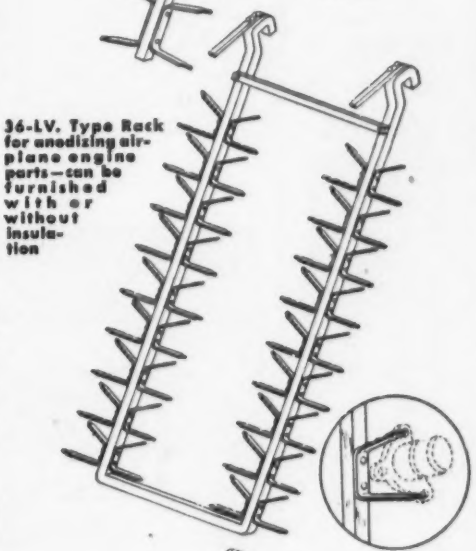


15-R-5 Cradle Type cadmium plating rack for fuse liners—where out and inside cadmium plating is required (insulated)

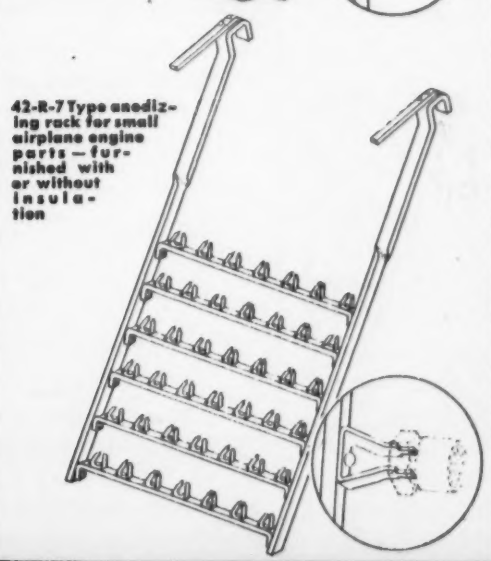
8-H Type Anodizing Rack for airplane engine parts shown not insulated — can be furnished insulated



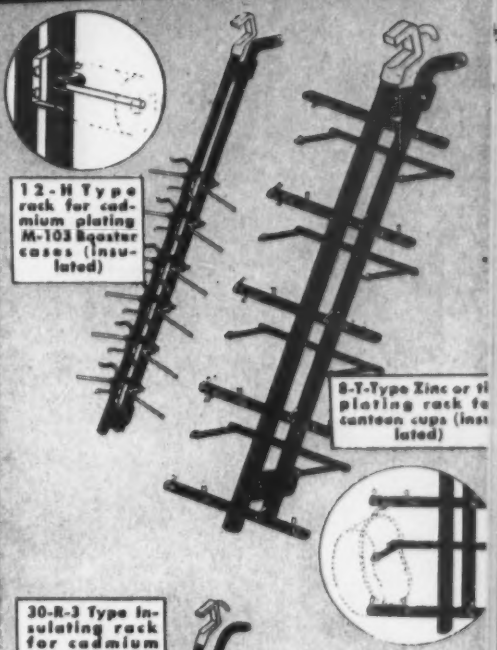
36-LV. Type Rack for anodizing airplane engine parts—can be furnished with or without insulation



42-R-7 Type anodizing rack for small airplane engine parts — furnished with or without insulation

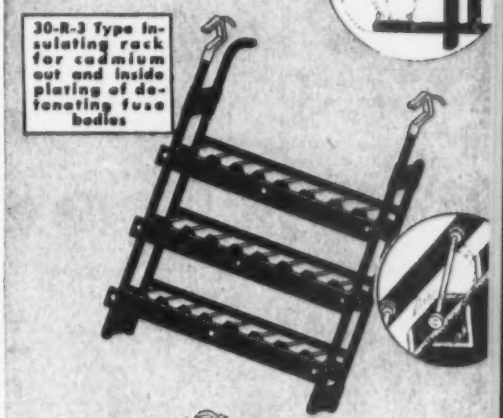


12-H Type rack for cadmium plating M-103 Booster cases (insulated)



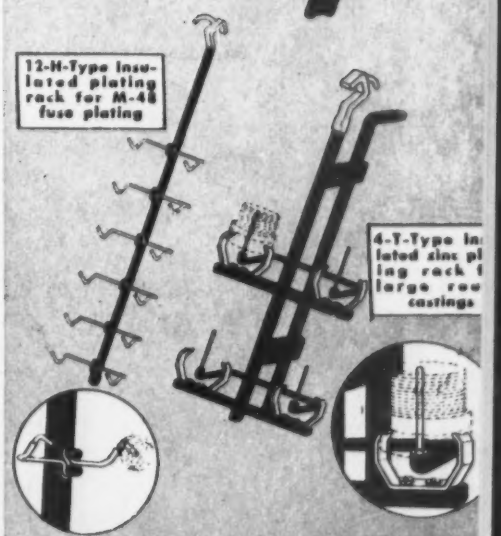
8-T-Type Zinc or ti plating rack fo canteen cups (insu lated)

30-R-3 Type insulating rack for cadmium out and inside plating of detonating fuse bodies



12-H-Type insulated plating rack for M-48 fuse plating

4-T-Type in lated zinc pl ing rack f large rou castings



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Instruments for the METALLURGICAL LABORATORY

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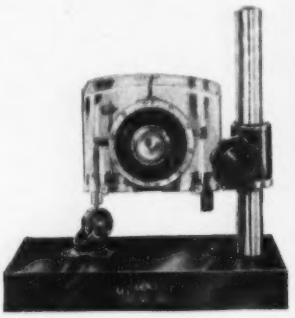
Measures thickness of magnetic coatings on non-magnetic base metals, non-magnetic coatings on magnetic base metals, and nickel coatings on iron or steel. Saves time and material, since its use will not injure coating or base metal.

Bulletin MF2125



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Ranges: —100° to 0° F. or —100 to 220° F.
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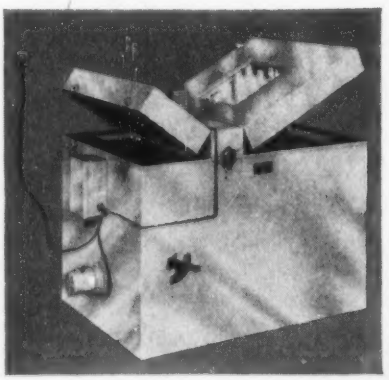
Bulletin MA2120



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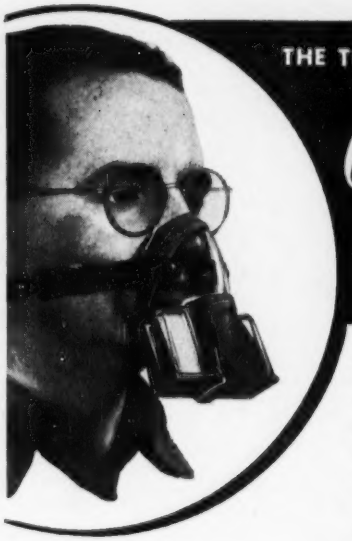
FOR BETTER DUST SAFETY—
BETTER COMFORT TOO!



THE TRANSPARENT *Clear-Vue* MODEL
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With facepiece and filter container of strong, transparent plastic, you can see inside this modern respirator at a glance. Officially approved by the U. S. Bureau of Mines for All-Dust protection, the Clear-Vue Dustfoe is durable, odorless, non-corrosive, non-conductive of electricity or heat. Its transparent construction permits checking for cleanliness, proper insertion and seal of filter, etc., without disassembly. The adjustable facepiece has a soft, molded face-cushion which provides maximum wearing comfort. Easily sterilized; all parts are interchangeable. Write for Bulletin No. CM-6.

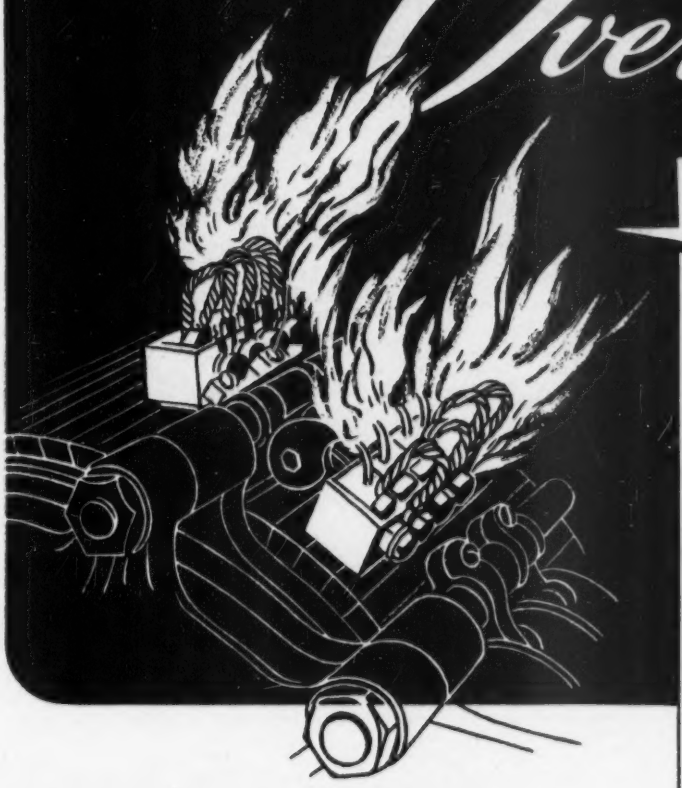
M·S·A *Comfo*
DUST RESPIRATOR
WITH PLASTIC FILTER CONTAINER

New plastic filter containers — thinner, with rounded edges — permit better downward and sidewise vision in the famous Comfo Respirator, *plus* even lower resistance to air-flow and improved appearance. Long a popular favorite in industrial service, the twin-filter Comfo is U. S. Bureau of Mines-approved for dependable dust protection—sturdy and durable for hard service. Rubber self-adjusting facepiece assures snug fit—simple to clean and sterilize. Ask for Bulletin No. CR-9.

Demonstrations Gladly Arranged on Request

MINE SAFETY APPLIANCES CO.
BRADDOCK, THOMAS AND MEADE STREETS
PITTSBURGH, PA.

BRUSHES *Overheating?*



LOOK FOR THESE CAUSES

High temperatures hasten breakdown in brushes. To locate and remedy overheating, check for:

1. **Severe sparking**
2. **Unequal and incorrect brush pressures**
3. **Overloading**
4. **High friction brushes**
5. **Insufficient ventilation**
6. **Too high ratio of brush surface to commutator**
7. **Chattering**
8. **Short circuiting currents**

WHATEVER YOUR BRUSH TROUBLES *Consult* SPEER

Whether it's overheating, sparking, pitting, chattering—in fact, any cause of poor brush operation—you'll save time and avoid needless machine damage by getting SPEER recommendations. SPEER will speed your trouble-shooting, prescribe the brush grade best suited to your operating setup. SPEER is ready to focus forty-five years of commutation experience on your problem. Do this to receive our counsel:

Send for SPEER Brush Data Forms—one for each plating generator or shop motor whose performance you want to better. We'll mail you these forms at once. Fill out and return them to us. Shortly after, you will receive our recommendations, which you may follow or not without obligation. We offer this service free, to help increase the effective use of power through better commutation. Write for any number of forms — on your business letterhead, please.

SCC

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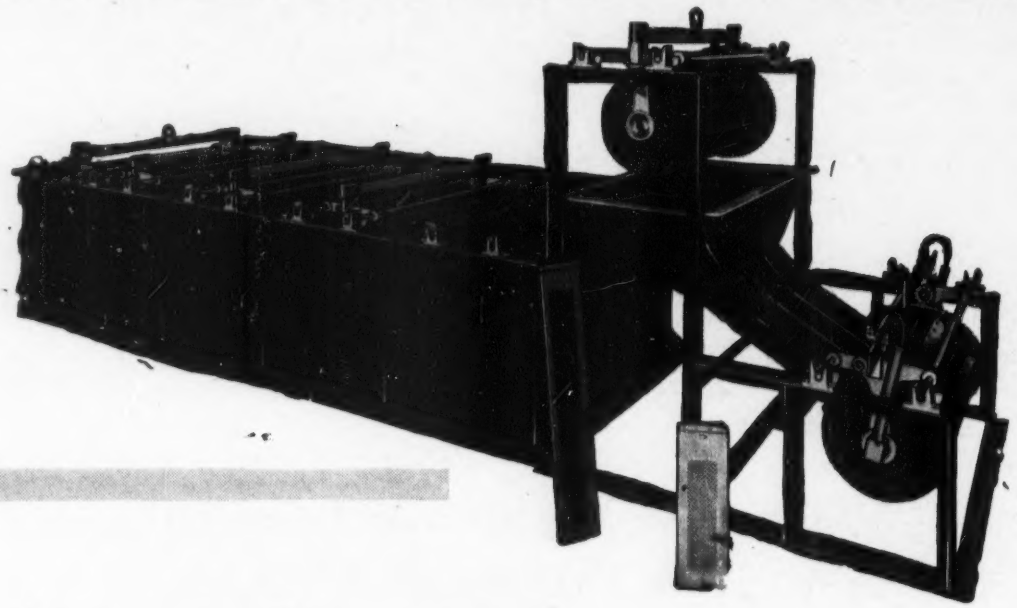
Use LASALCO AUTOMATIC FINISHING ROOM EQUIPMENT



Today's tremendous War production problems demand fast, efficient, dependable plating and finishing room equipment that can be handled with a minimum of manpower. Lasalco Multiple Cylinder Cleaning —Plating—Rinsing Machines can do exactly that for you.

Revolving cleaning cylinders burnish work while cleaning. Transfer of work after thorough rinsing to and from plating cylinders before and after plating is quickly effected with transfer hoppers, eliminates staining, and reduces labor cost. Plating cylinders are exceptionally resistant to corrosion and abrasion.

Call a Lasalco Engineer to help you select the right equipment to do your job. He's a specialist in plating and finishing problems, who can save you time and trouble by doing the job *right* the first time.

—To Increase War Production Output

—To Conserve Man Hours

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PALMER H. LANGDON
1868-1935

METAL FINISHING

VOLUME 41 OCTOBER, 1943 NUMBER 10

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US
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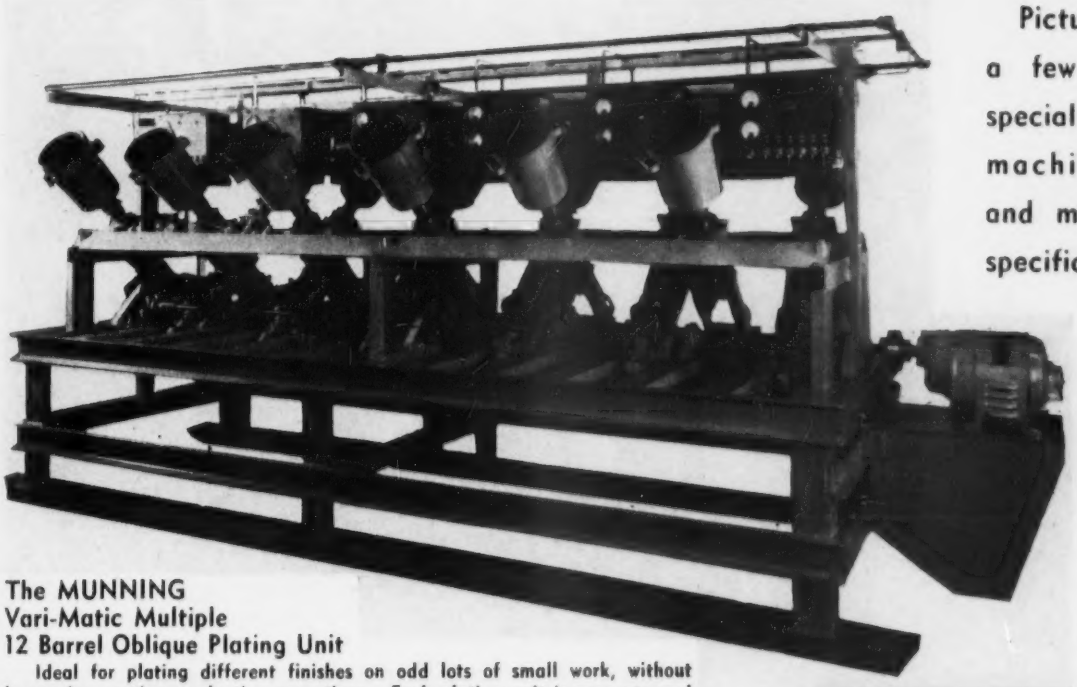
Munning Plating Machines

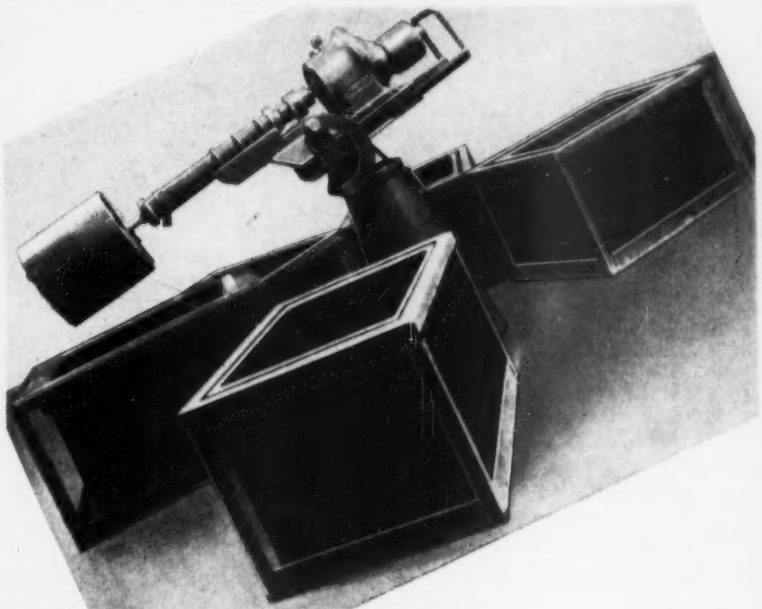
Pictured here are just a few of the many special type Munning machines designed and manufactured for specific applications.



The MUNNING
Vari-Matic Multiple
12 Barrel Oblique Plating Unit

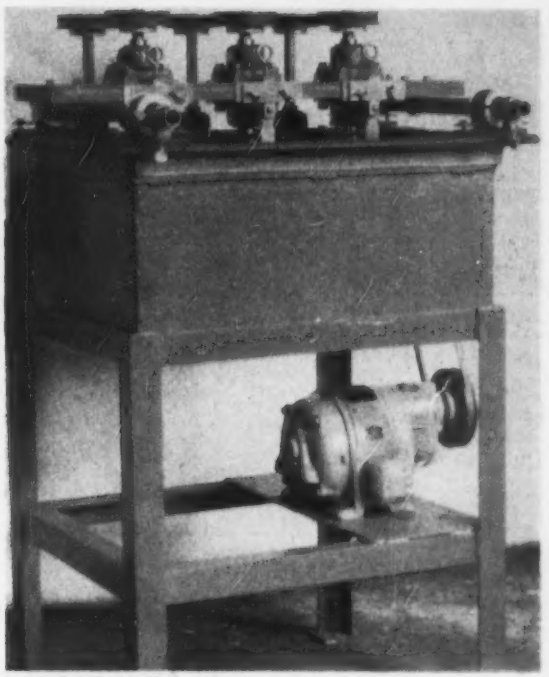
Ideal for plating different finishes on odd lots of small work, without hampering routine production operations. Each plating unit is separate and operated independently of the adjoining units. The plating barrels are interchangeable and readily removed and replaced for loading and unloading. Available in any number of multiple sections.

Our equipment covers a wide field, embracing numerous metal finishing treatments, such as Electroplating, Electrocleaning, Anodizing, Descaling, Jetalizing, Dipping, Pickling, Deburring, Tumbling and other processes. Your inquiries are solicited and our service is cordially extended.



The MUNNING Type G-9 Pickling and Plating Machine

Among the impressive features of this unique tool are its complete sweep of movement in either direction through a full 360 degrees without interference from electrical wiring, its equilibrium and its direct driven rotating basket.



Multi-Spindle
Rotor Plating Machine

The above three position machine is the smallest member of a group of special appliances for electroplating the internal surfaces of bearings, bushings and other cylindrical parts.

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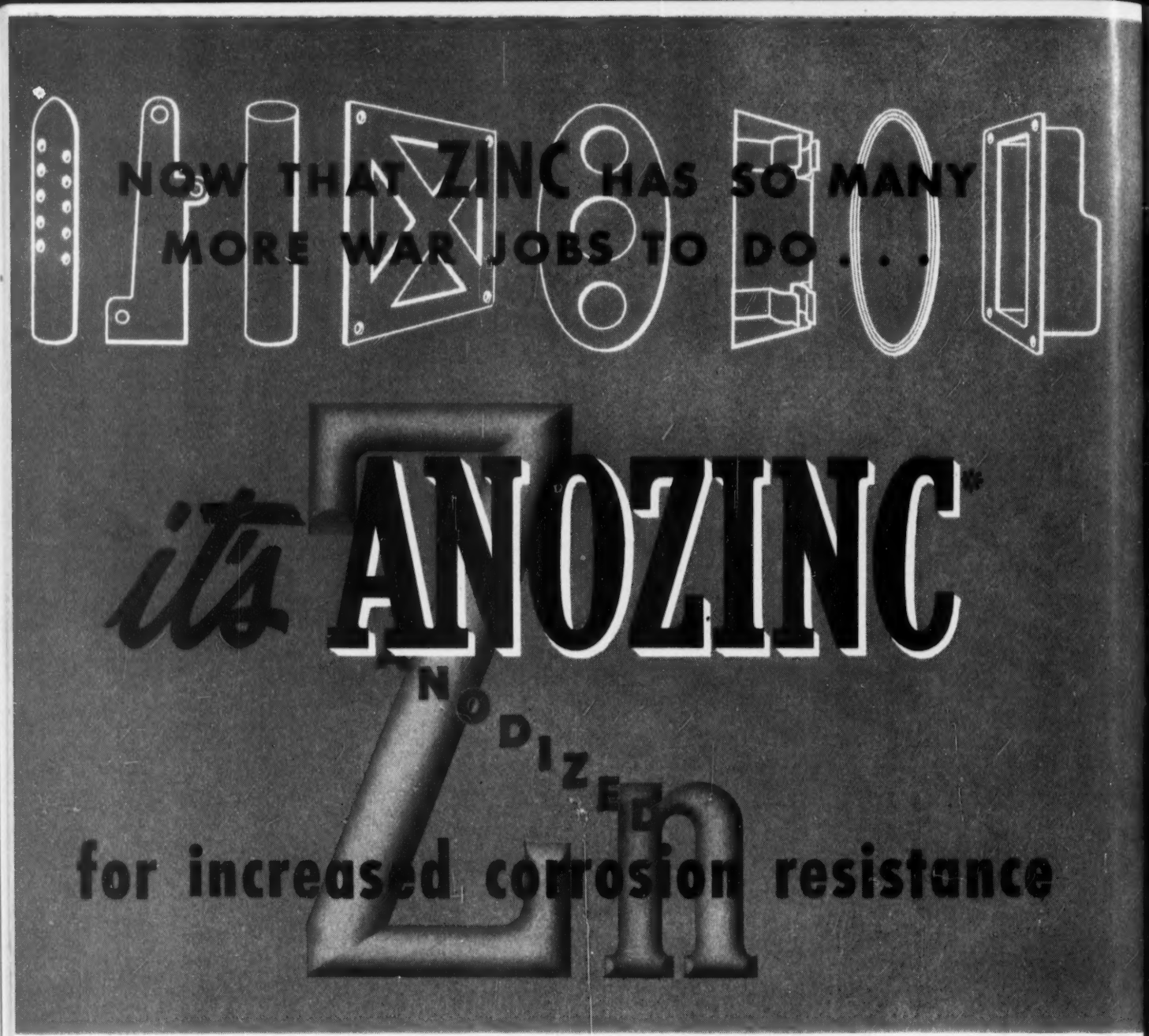
New York - - - - Philadelphia - - - - Woonsocket, R. I.



Have you switched from *brass* or other hard-to-get materials—to *steel*—and then zinc plating for rust-proofing? Then you can step up that corrosion resistance still further—get a more attractive finish as well—with ANOZINC! In fact, you can make this steel-and-zinc plating procedure suitable for countless more applications where outdoor exposure, corrosion and handling are encountered.

Here in a nutshell is what ANOZINC offers:—

A fast, inexpensive method of producing by anodic treatment, an attractive, resistant coating on zinc plating and certain zinc base die castings.

For countless parts now being plated or black finished, this treatment will mean improved appearance as well as longer service life. Parts finished in ANOZINC baths have stood up in excess of 200 hours under the Army-Navy salt spray test AN-QQ-S-91.

Two attractive finishes are available—a dark semi-lustrous black, and a brassy, slightly iridescent yellow—a different bath being used for each color.

Existing plating facilities in most cases, can be readily converted for use with this process. The constituents of ANOZINC baths are stable and can be easily controlled by any competent plater. The salts are inexpensive and no license agreement need be executed.

For further information write to the nearest office below, indicating the size, quantity and nature of the parts to be treated, the basic metal and type of zinc plating used. Your inquiry will receive immediate attention.

☆ *Trade-mark Reg. U. S. Pat. Off.*

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Waterbury, Conn. ☆ Detroit, Mich.

FOR FAST, EFFICIENT PLATING OF SMALL WAR-IMPLEMENT PARTS

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H-VW-M MERCIL TYPE OBLIQUE PLATING APPARATUS

pacity: Approximately 2½ gallons of solution and from 3 to lbs. of work per cylinder per load, depending upon nature work.

lti-cylinder Units: Available with any desired number of inders, all driven directly by a single motor.

linders: Steel, covered inside and out with ⅛" rubber. Cyl- rs are octagonal, with tapered sides.

ds: Normal speed is approximately 6 R.P.M., but simple gear ges permit speeds of 10-12 R.P.M. or 32-34 R.P.M.

bling: Many of our customers have found these units suit- for tumbling operations.

H-VW-M NO. 34 MOTOR DRIVEN OBLIQUE PLATING APPARATUS

Capacity: 25 lbs. of work per load.

Tank: Asphalt-lined wood, unlined steel, or steel lined with 3/16" vulcanized rubber.

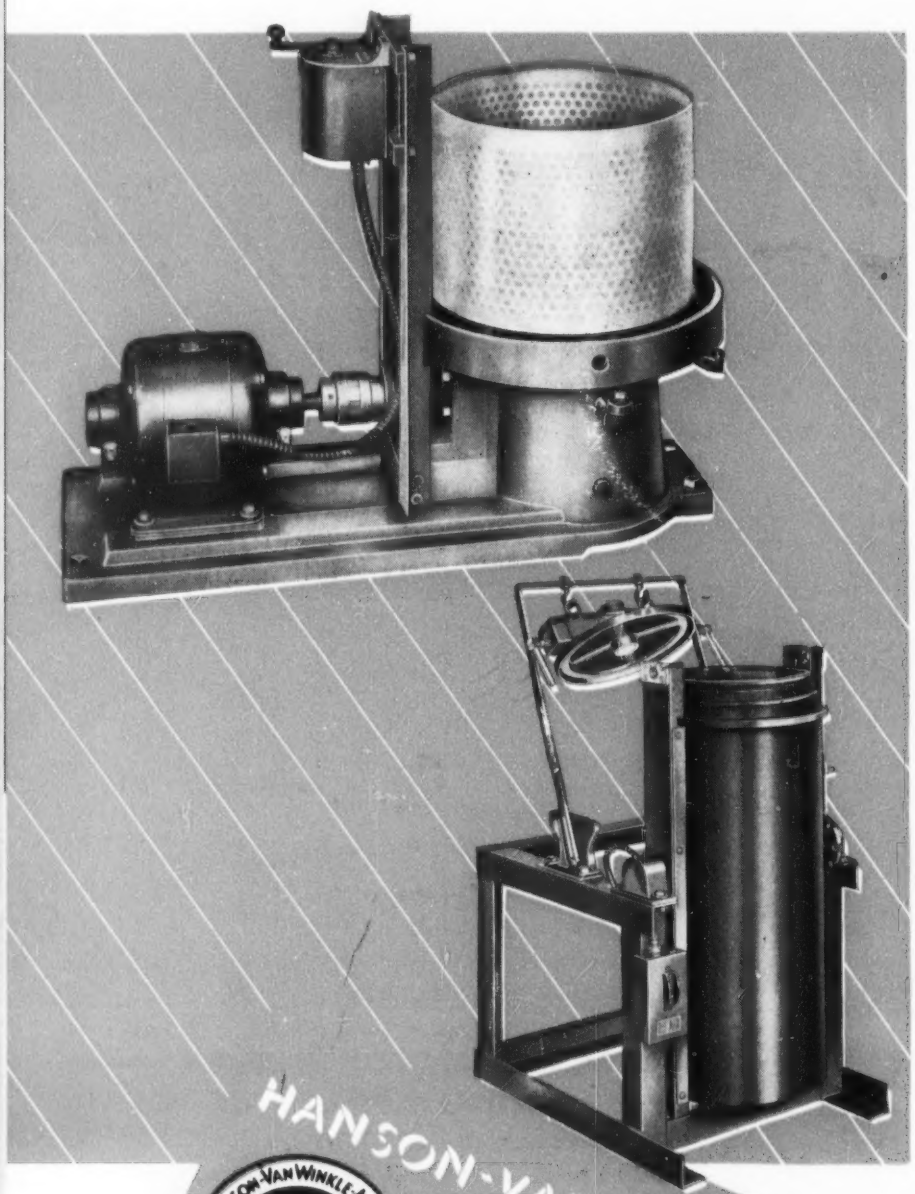
Cylinder: Bakelite with either disc or button contacts or hard rubber with disc contacts only. Cylinder is easily removable for rinsing, loading and unloading.

Drive: Cylinder is directly driven by a 1/6 H.P. motorized worm gear reducer, mounted on the tank and requiring only connection to electric outlet.

Also available from H-VW-M is horizontal type barrel plating equipment in single and multiple cylinder units with bakelite or hard rubber cylinders.

Full Details on all these units will be found in H-VW-M 20-page Bulletin PB-106, yours free for the asking.

TO SAVE TIME AND IMPROVE UNIFORMITY ON WAR WORK



Where small parts are handled on a production basis, H-VW-M Mercil Type Centrifugal Dryers* and Burnishing Barrels* speed work and enable uniform, accurately predetermined results. Both units occupy minimum floor space. Both are ideal for use with plating barrels.

H-VW-M MERCIL TYPE CENTRIFUGAL DRYERS

provide the speediest, most economical method of drying small plated parts. Two sizes are available: No. 1, driven by a ½ H.P. motor, handles baskets up to 12″ x 12″; No. 2, driven by a 1 H.P. motor, handles baskets up to 18″ x 18″. Both sizes can be furnished with forced hot air drying equipment, either electrical or steam. Large bearings and excellent balance virtually eliminate vibration. Conveniently located motor control facilitates starting, stopping, or reversing at will.

H-VW-M MERCIL TYPE BURNISHING BARRELS

are self-contained units, hence unusually simple to install. Barrel, drive gears and motor are all mounted in one movable unit, permitting direct drive and operation at any angle. A unique cover lifting device speeds and simplifies loading. The barrel proper is octagonal, made of welded sheet steel and equipped with hard maple blocks. A steel shield covers barrel, motor and gears, making the unit completely splash-proof. Two sizes are available: No. 1, with inside dimensions 11⅜″ x 24″ and No. 2, with inside dimensions 14¼″ x 30″.

***H-VW-M Mercil Type Centrifugal Dryers are described in Bulletin CD-101.**

H-VW-M Mercil Type Burnishing Barrels are described in Bulletin BB-103.

4834

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VOL. 41, NO. 10 METAL FINISHING OCTOBER, 1943
PREPARATION, ELECTROPLATING, COATING

Plan Postwar Jobs—Now

The above is the title of a booklet prepared by the Field Development Division of the Committee for Economic Development, which will serve as an excellent guide for the businessman interested in postwar opportunities.

Prepared primarily for manufacturing and allied businesses whose success is dependent on national economic factors rather than on local economic conditions, and therefore applying to our industry perfectly, this booklet describes postwar goals and approaches to be employed in attaining these goals.

The U. S. Department of Commerce estimates that a civilian labor force of approximately 57,500,000 will be available three years from now. Millions of these workers must be placed in industry when peace comes, and they must be placed quickly lest extended unemployment give rise to government make-work programs much greater in scope than those with which the taxpayer was burdened only a few years ago. Industry must plan now in order to avoid such contingencies—it cannot and dare not defer this planning until after the war.

In laying out business objectives and determining the possibilities for creating new job opportunities, valuable time can be saved by having a basic approach to the problem. This approach has now been outlined effectively and it is suggested that the ideas contained in the booklet, which may be obtained by writing the committee in Washington, D. C., be carefully considered by industrial employers. It contains no answers but it does tell how answers may be found by practical, scientific planning.

Metal Congress at Chicago

October 18-22

EXTENSIVE preparations and plans are now being completed for the National Metal Congress and the War Conference Displays to be held under the auspices of the American Society for Metals at the Palmer House, Chicago, the week of Oct. 18.

At a recent meeting of the A.S.M. Publication Committee, the technical program was completed and the papers assigned to the various sessions. It will be observed that arrangements have been made for three sessions per morning, with the exception of Wednesday when the annual meeting of the Society will be held. This is to be followed immediately by the Campbell Memorial Lecture, which will be presented this year by C. H. Mathewson, professor of metallurgy, Yale University.

Wednesday afternoon will feature a session on post-war planning in the non-ferrous metals. Changes that may reasonably be expected in metals generally and in metallurgy will be discussed in a session scheduled for Thursday afternoon. On the same afternoon a simultaneous discussion will deal with light-weight construction for the post-war era and in addition to aluminum, magnesium and stainless steels, there will be a review of the place plastics and wood will have in this picture.

The 11:30 a.m. daily inspirational sessions, which have been addressed at previous conventions by outstanding figures in the Army, Navy and War Production Board, will again occupy a prominent place on the program.

War Production Sessions

The afternoons will be devoted to the War Production Sessions. The final program will be a composite of suggestions received from 1200 prominent members of the Society. The same type of informal discussion meeting which was widely acclaimed at previous conventions will be used again at Chicago.

The theme of the War Production Sessions will be "Increased production of war products, conservation of materials, and post-war conditions."

Displays

While there will be no installations of heavy equipment, such as displayed in previous gatherings, many of the manufacturers are planning to display light equipment, blueprints, diagrams, charts, and other items to assist their technical and manufacturing staffs in the conferences.

Participants

The following societies will again cooperate in the Metal Congress:

American Society for Metals

American Institute of Mining and Metallurgical Engineers; Institute of Metals Division and Iron and Steel Division

American Welding Society

Wire Association.

TECHNICAL PROGRAM

American Society for Metals

Palmer House, Chicago, October 18-22

Monday Morning, October 18

1. "Quenching and Hardenability of Hollow Cylinders," by *J. H. Hollomon* and *C. Zener*, Watertown Arsenal.
2. "Rates of Cooling in Blocks and Cylinders," by *C. B. Post* and *W. H. Fenstermacher*, Carpenter Steel Co.
3. "An Evaluation of Quenching Oils," by *E. K. Spring, P. T. Lansdale* and *C. W. Alexander*, Henry Disston & Sons, Inc.

Simultaneous Session

4. "An X-Ray Study of Brasses Formed by the Interdiffusion of Copper and Zinc Deposited on Glass by Vaporization," by *A. A. Burr*, Armstrong Cork Co.; *H. S. Coleman, H. L. Yeagley* and *W. P. Davey*, Pennsylvania State College.
5. "Dimensional Changes Encountered in Tube Sinking," by *W. M. Baldwin, Jr.* and *T. S. Howald*, Chase Brass & Copper Co.
6. "A Metallographic Study of the Decomposition of Austenite in Manganese Steels," by *John V. Russell*, Republic Steel Corp., and *Francis T. McGuire*, University of Kentucky.

Simultaneous Session

7. "The Microhardness Tester as a Metallurgical Tool, by *Constance B. Brodie*, General Electric Co.
8. "Intercrystalline Cohesion of Metals," by *E. R. Parker*, General Electric Co.
9. "Plastic Flow and Rupture of Metals," by *C. Zener* and *J. H. Hollomon*, Watertown Arsenal.

Tuesday Morning, October 19

10. "The Effect of Varying Amounts of Martensite Upon the Isothermal Transformation of Austenite Remaining After Controlled Quenching," by *H. J. Elmendorf*, American Steel & Wire Co.
11. "Martensite Reaction in Alloy Steels," by *Peter Payson* and *Charles H. Savage*, Crucible Steel Company of America.
12. "Influence of Nickel, Molybdenum, Cobalt and Silicon on the Kinetics and Ar" Temperatures of the Austenite to Martensite Transformation in Steels," by *H. H. Chiswick*, Battelle Memorial Institute, and *A. B. Greninger*, University of Chicago.

Simultaneous Session

13. "High Speed Testing of Mild Steel," by *J. H. Hollomon* and *C. Zener*, Watertown Arsenal.
14. "The Effect of Heat Treatment and Carbon Content on the Work Hardening Characteristics of Several Steels," by *John H. Hollomon*, Watertown Arsenal.
15. "The Tensile Properties of Alloyed Ferrites," by *C. E. Lacy*, International Nickel Co., and *M. Gensamer*, Carnegie Institute of Technology.

Simultaneous Session

16. "A Study of the Nitriding Process—I. Effect of Ammonia Dissociation on Case Depth and Structure," by *Carl F. Floe*, The Nitralloy Corp.
17. "The Action of Carbonate Catalysts in the Carburization of Steel," by *T. C. Fong* and *R. A. Ragatz*, University of Wisconsin.

18. "The Isothermal Transformation of Case-Carburized S.A.E. 4815," by *J. R. Cruciger* and *J. R. Vilella*, United States Steel Corp.

Wednesday Morning, October 20

Annual Meeting of American Society for Metals

Edward de Mille Campbell Memorial Lecture, by *C. H. Mathewson*, Professor of Metallurgy, Yale University.

Thursday Morning, October 21

19. "Order Hardening: Its Mechanism and Recognition," by *David Harker*, General Electric Co.

20. "Interrupted Quench and Isothermal Treatments of Precipitation Hardening Alloys: Introductory Notes," by *R. H. Harrington*, General Electric Co.

Simultaneous Session

21. "Bright Gas Quenching of S.A.E. X-4130 Welded Aircraft Tubes," by *Wm. Lehrer*, Surface Combustion.

22. "Some Effects of Heat Treatment on Low Alloy Titanium Steels," by *George F. Comstock*, Titanium Alloy Manufacturing Co.

23. "Effect of Time, Temperature and Prior Structure on the Hardenability of Several Alloy Steels," by *J. Welchner, E. S. Rowland* and *J. E. Ubben*, Timken Roller Bearing Co.

Simultaneous Session

24. "The Stress Distribution at the Neck of a Tension Specimen," by *P. W. Bridgman*, Harvard University.

25. "Notched Bar Tensile Test Characteristics of Heat Treated Low Alloy Steels," by *G. Sachs, J. D. Lubahn* and *L. J. Ebert*, Case School of Applied Science.

26. "The Strength of Heat Treated Alloy Steel Bolts," by *G. Sachs, P. S. Cole* and *R. A. Roth*, Case School of Applied Science.

Friday Morning, October 22

27. "The Emissivity of Molten Stainless Steels," by *George N. Goller*, Rustless Iron and Steel Corp.

28. "Quenching Rate Versus Graphite Formation in Prequenched White Cast Iron," by *Orien W. Simmons*, Battelle Memorial Institute.

29. "Pseudomorphs of Pearlite in Quenched Steel," by *Owen W. Ellis*, Ontario Research Foundation.

Simultaneous Session

30. "Structural Changes During the Tempering of High Carbon Steel," by *D. P. Antia, S. G. Fletcher* and *Morris Cohen*, Massachusetts Institute of Technology.

31. "The Effect of Carbon on the Tempering of Steel," by *Stewart G. Fletcher* and *Morris Cohen*, Massachusetts Institute of Technology.

32. "The Tempering of Nickel and Nickel-Molybdenum Steels," by *Dara P. Antia* and *Morris Cohen*, Massachusetts Institute of Technology.

33. "Effect of Quenching-Bath Temperature on the Tempering of High Speed Steel," by *Paul Gordon* and *M. Cohen*, Massachusetts Institute of Technology, and *R. S. Rose*, Vanadium-Alloys Steel Co.

Simultaneous Session

34. "An Emergency Heat Resistant Alloy," by *O. E. Harder* and *James T. Gow*, Battelle Memorial Institute.

35. "An Optimum Silicon Range in Plain and 2.0 Per Cent Chromium Cast Irons Exposed to Elevated Temperatures," by *C. O. Burgess* and *R. W. Bishop*, Union Carbide & Carbon Res. Lab.

36. "Creep Strength, Stability of Microstructure and Oxidation Resistance of Chromium-Molybdenum and Chromium-Nickel Steels," by *R. F. Miller, W. G. Benz* and *M. J. Day*, United States Steel Corp.

AIME METALS DIVISIONS' EVENTS

Hotel Sherman, Chicago, Oct. 16-20

Saturday, October 16

Noon—Joint Luncheon

Afternoon—Session on Production of Magnesium

The Pidgeon Process.

Operations at Basic Magnesium, Inc.

The Kaiser Seawater Plant and Hansgirg Process.

Sunday, October 17

Morning—Field Trips

To Strip Operations of Northern Illinois Coal Co. and Open Pit Operations of Illinois Clay Products Co., near Joliet.

Alternate Trip: Special Conducted Tour of Museum of Science and Industry, Jackson Park.

Noon—Luncheon for Field Trips

Afternoon—Technical Session

"Coal and Oil Resources of Illinois," by *M. M. Leighton*, Director, Illinois Geological Survey.

Evening—Dinner Meeting, Chicago Section

"Fuels of the Future," by *Ralph Sherman*, Battelle Memorial Institute.

Monday, October 18

Morning—Regional Meeting on Refractory Problems from the Production Man's Standpoint

Refractory Problems in Ferrous Metal Production.

Refactory Problems in Non-Ferrous Metal Production.

Meeting the Difficulties.

Iron and Steel Division

Theory of Deep Drawing; Two papers, arranged by *Karl Fetters*.

Institute of Metals Division

Physical Metallurgy and Electron Microscope.

Noon—Joint Luncheon

Afternoon—Regional and Iron and Steel Division

Description and Economics of Kaiser Plant at Fontana.

Description and Economics of Columbia Steel Co. Plant at Geneva, Utah.

Iron and Steel Division

Symposium on Deep Drawing.

Institute of Metals Division

Symposium on Practical Aspects of Diffusion, arranged by *E. A. Anderson*.

4:00 P.M.—General Meeting, Board of Directors

Evening—Joint Regional and Divisional Dinner

Tuesday October 19

Morning—Iron and Steel Division

Hardenability and Jominy Tests.

Institute of Metals Division

Copper and Copper-Rich Alloys.

Noon—Luncheon Meeting
Executive Committee, Iron and Steel Division

Afternoon—Symposium

Joint Symposium on Cohesive Strength; Four technical papers plus informal discussion, arranged by *Maxwell Gensamer*.

Wednesday, October 20

Noon—Luncheon Meeting
Executive Committee, Institute of Metals Division

Afternoon—Iron and Steel Division

Symposium on Segregation in Steel.

Institute of Metals Division

Technical Session on Physical Metallurgy.

WIRE ASSOCIATION

La Salle Hotel, Chicago, Oct. 18-21

Monday, October 18

10:30 A.M.—Directors' Meeting

12:30 P.M.—Directors' Luncheon to Program Committee and Speakers

2:30 P.M.—Technical Session

"Designing Mills for Government Purposes," by *Paul M. Mueller*, Revere Copper and Brass Co.

Tuesday, October 19

10:00 A.M.—Technical Session

"Work Simplification," by *Mogensen* (Lecture and Motion Picture).

"Steel Rope Wire Drawing Practices," by *John C. Aiken*, Jones & Laughlin Steel Corp.

2:30 P.M.—Technical Session

"The Use of Lead Base Coatings as a Substitute for Zinc," by *C. A. Kellogg*, Continental Steel Corp.

"Plating of Steel Wire," by *Rodman R. Tatnall*, Wickwire Spencer Steel Co.

Wednesday, October 20

10:00 A.M.—Technical Session

Mordica Memorial Lecture, by *Flint C. Elder*, American Steel & Wire Co.

12:30 P.M.—Wire Association Luncheon

Speaker—*Capt. A. J. Wellings*, Chief of Navy Material Inspection, Navy Department.

4:00 P.M.—Wire Association Annual Meeting

7:00 P.M.—Annual Smoker-Dinner

Thursday, October 21

10:00 A.M.—Technical Session

"Drawing of Fibers," by *Sydney Coppick*.

"Properties and Uses of Vinyl Resins for Wire and Cable," by *G. A. Fowles*, B. F. Goodrich Co.

2:30 P.M.—Technical Session

"Glass Insulation; Its Uses and Properties," by *L. T. Russell*, Owens-Corning Fiberglas Corp.

"The Application of Synthetic Compounds to Wire by Extrusion," by *H. K. Intemann*, Halowax Products Div., Union Carbide & Carbon Corp.

Rubber in Industry—Motion Picture.

PROGRAM OF AMERICAN WELDING SOCIETY

Hotel Morrison, Chicago, Oct. 18-21

Monday, October 18

9:30 A.M.—Opening Session

Presentation of medals and prizes; the Adams lecture.

2:00 P.M.—Sessions on Cutting; Railroads; Weldability

Subjects: Flame Cutting Heavy Sections and Large Diameters; Welding and Cutting in Steel Mills; Electronic Control of Gas-Cutting Machines; Machine Cutting for Assembly Line Fabrication; The Welded Locomotive Boiler; Welding as it Applies to Railroads; Railroad Shop Welding and Cutting; Welding of Railroad Transport Equipment; Investigations at Lehigh, R. P. I.; The Weldability of Silicon Steels; Weld Bead Hardness Tests on Plain Carbon, Nickel and Nickel-Chromium Steels; Evaluation of Weldability by Correlation of Electrical Constants.

7:30 P.M.—Educational Session

General Electric Film on Atomic Hydrogen Welding. Address on Welding in Ordnance Construction.

Tuesday, October 19

9:30 A.M.—Sessions on Resistance Welding; Tubing; Flame Hardening; Hard Facing; Ships

Subjects: Flash Welding of Alloy Steels; Spot Welding of Heavy Gauges of Carbon and Alloy Steels; Welded Steel Tubing; Machine Welded Metal Tubing; Oxy-Acetylene Tube Welding; Ordnance Flame Hardening; Hard Facing in the War on Wear; Hard Facing; Welding in Ship Construction; Pre-fabrication of Welded Ships; Control of Welding in Ship Construction.

2:00 P.M.—Sessions on Resistance Welding; Ships; Research

Subjects: The Weld Recorder; Double Pressure Systems as Applied to Resistance Welding Machines; Stored Energy Welding of Mild Steel; Flash Welding of Nickel and High Nickel Alloys; Planning for Production Welding and Cutting; Thermit Welding in Maritime Commission Work; Longitudinal Welded Joints; Fatigue Strength of Fillet Welded Joints; Evaluating the Weldability of Alloy Steels; Investigation of a Normalizing Procedure to Improve the Grain Structure of Welds in Carbon Molybdenum Pipe; Correlation of Structure and Strength of Spot Welds in Aluminum Alloys.

7:30 P.M.—University Research Conference

Wednesday, October 20

9:30 A.M.—Sessions on Aircraft; Non-Ferrous Welding and Brazing; Piping

Subjects: Fatigue Strength of Welded Aircraft Joints; Spot Weldability of Low Carbon and Other Aircraft Steels; Weldability Tests of Aircraft Structural Steels; Modern Welding Methods for Copper and Copper Alloys; Carbon Arc Welding of Naval Brass; Fundamentals of Metal Flow in Aluminum Brazing Sheet; Oxy-Acetylene Distribution Systems; Large Welded Pipe Lines; Weldability of 27% Chrome Steel Pipe.

2:00 P.M.—Sessions on Aircraft; Inspection, Qualification and Training; Repair and Maintenance.

Subjects: The Heliarc Welding of Magnesium Alloys Used in Airplane Fabrication and Substitution for Critical Materials; Fatigue Studies of Welded Test Triangular Structure with NE8630 Steels; Fabrications and Welding of Aircraft Exhaust Tubing (Manifolds and Headers); Metallic Arc Welded X-4130 Steel Tubing; Applicable Methods of Inspection of Arc Welding to (1) Ship Building, (2) Structural, (3) Pressure Vessels and Piping, (4) Aircraft, (5) Machinery; Bronze Welding in the Design and Maintenance of Forming Dies; The Past, Present and Future of the Job Shop; Maintenance of Tools and Equipment; Reclamation of Tools by Low Temperature Brazing.

7:30 P.M.—Section Officers' Dinner and Conference

Thursday, October 21

9:30 A.M.—Sessions on Aircraft, Production and Pressure Vessels

Subjects: Quality Control of Aircraft Spot Welding; The Application of Flash Welding in Airplane Construction; Spot Weld Joint Efficiency for Aluminum Alloys; Spot Welding of Magnesium Alloys; Automatic Arc Welding Solves Production Problems; Transition from Riveted to Welded Construction of Light Tanks; Welding of Armored Tanks; War Emergency Codes for Welded Pressure Vessels; The Hammer Test for Welded Pressure Vessels.

2:00 P.M.—Business Meeting

3:00 P.M.—Board of Directors' Meeting

The Preparation of Metal Coatings for Microscopic Examination

By DR. WALTER R. MEYER

Technical Director, The Enthone Co., New Haven, Conn.

THE technique of preparing metal coatings for microscopic examination is somewhat different from that necessary for the preparation of massive specimens. Care must be taken that the coating is not rounded in polishing so that the entire cross-section can be brought into focus at one time. In addition, dissimilar metals are usually present and this commonly results in an electrochemical action during etching so that swab etching or immersion etching may result in smutty, poorly resolved structures. The various steps in the preparation of cross-sections for microscopic examination will be discussed in order.

Mounting of the Specimen

Before the specimen is mounted, a back-up coating should be applied by plating. Copper and chromium plating have been found to be most generally suitable. Cut about one square inch of the specimen and wire it for plating. For hard deposits, such as nickel, a chromium plate of the order of 0.001" is ample. This plate can be obtained by plating for about one hour at two amperes per square inch. Chromium plate is particularly good because it adheres well to nickel and other plates, it is hard, and the edge of the plate can be clearly defined. It acts as a noble metal in most etching solutions and thus minimizes electrochemical action during etching.

For backing up zinc, cadmium, silver, tin, lead and gold, a copper coating at least 0.001" is preferred. This is particularly true when the coatings are very thin and where chromic acid solutions may have some solvent action on the plate before the plate has been built up to prevent such action. The specimen can be backed up completely by copper plating from a cyanide solution. However, due to the slowness of deposition of copper from cyanide solutions, it is usually faster to apply about 0.0001" of copper from a cyanide solution and build up the remainder of the back-up coating by plating from an acid copper solution.

After backing up the specimen, it can then be mounted in plastic using the usual presses available for this purpose. However, the writer has found polishing to be more satisfactory when the specimen is mounted in a low-melting alloy such as tin-lead eutectic, or Wood's metal, the compositions and melting points of which follow:

	Wood's Metal	Tin-Lead Eutectic
Melting Point	155° F.	361° F.
Tin	12.5%	62.0%
Lead	25.0 "	38.0 "
Bismuth	50.0 "	...
Cadmium	12.5 "	...

The usual phenolic and methacrylate resins are tough, and paper polishing and abrasive finishing are faster with low melting alloys. It may be argued that plastic mounting will prevent any danger of electrochemical action between the specimen and the mounting medium during etching. However, the polish-etching technique to be described and the back-up coating prevent electrochemical action.

A technique that has been recommended for mounting flat specimens involves placing several flat sheets together and fastening them tightly with several bolts or clamps. It has been found difficult to secure tight, uniform clamping, but the major disadvantage of this technique is that the assembly is jagged, is difficult to hold while polishing, and the corners tend to catch on the wheel.

When mounting with low-melting alloys, a cylindrical shell of metal about ¾-1" in diameter is used. The shell is placed on a smooth sheet of metal (metal is preferred because the solder cools more rapidly). The specimen is cut to fit inside the shell, it is held parallel to the walls of the shell and the solder is poured into the shell. After a little experimentation, a person can do the mounting alone, but a beginner usually needs someone to pour in the solder while he holds the specimen and shell in place.

Rough Polishing of the Specimen

After mounting, the specimen is faced off in a lathe or by means of a belt sander. The lathe is preferred because a 90° angle is easier to obtain and it is necessary to polish the specimen at 90° or high values of thickness will be obtained. If the specimen is turned on a lathe, cut back the mounting ring so that it will not have to be polished, and round off the periphery to prevent tearing.

The specimen is now ready for paper polishing. Metallographic emery polishing paper is commercially available in many degrees of fineness. Starting from coarse paper and going to the fine paper, the sizes are designated as 2, 1, 0, 00, 000, 0000. In general, it is not wise to attempt to skip any of these papers. Actually, faster polishing can be done by proceeding through the various sizes than by attempting to jump over any sizes. In addition, if any sizes are skipped, it is almost impossible to remove scratches from previous polishing.

The specimen is held firmly with the thumb and the first two fingers and polished with a back-and-forth motion *and not with a circular motion.* Some operators prefer to use the paper dry but the writer does not consider this to be good practice. In the first place, dry paper fills up and glazes over very quickly and cutting action is lost rapidly. Secondly, rough particles may remain on the cutting surface and mar the specimen. The preferred

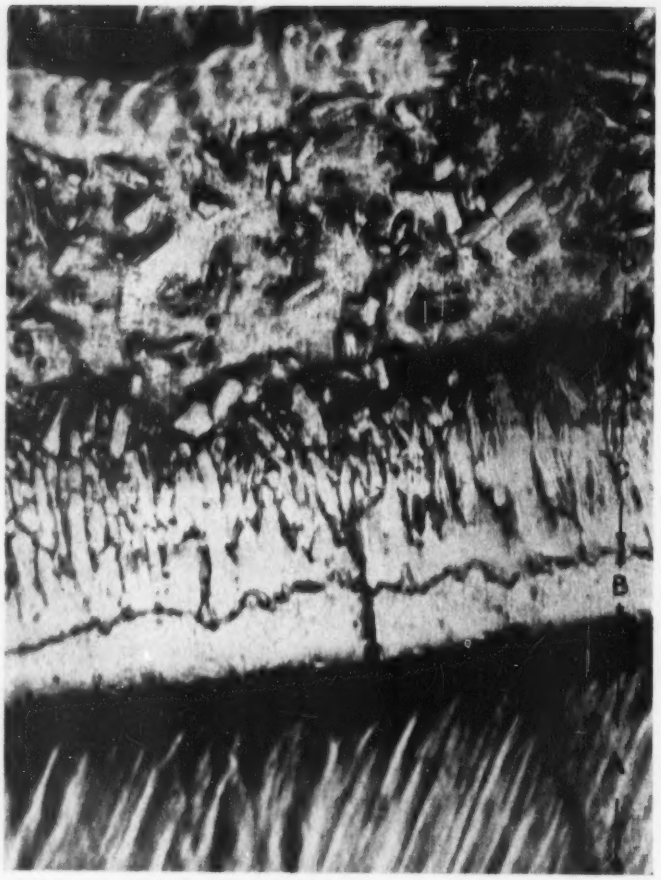

Fig. 1. A cross-section photomicrograph of a hot-galvanized coating which was polished through 000 paper and then etched. Magnification 500x. Identification: A—base metal; B—Fe_3Zn_{10}; C—$FeZn_7$; D—free zinc with $FeZn_7$ platelets.

technique is to place the polishing paper on a piece of smooth plate glass placed at an angle of about 10 degrees. Kerosene is then dropped from a dropping flask so that the drops fall just above the upper limit of the stroke. In this manner the kerosene acts as a lubricant, washing away the abrasive material, and keeping a cleaner cutting surface. The bottom of the plate glass can be placed in a trough to catch the kerosene.

After all of the circular lathe marks are removed and all of the scratches run in one direction, the specimen is ready for polishing with the next finer emery paper. The specimen contains some kerosene with finely divided metal and emery. It should be cleaned to prevent carrying any coarse grit onto the next paper. A special "Metallographic Cleaner" is available for this purpose. This is an emulsifiable solvent type material that blends with the kerosene and is then washed off with running water. The specimen is immersed in the cleaner, held under running water and dried with air or alcohol. The glass plate should be wiped clean to remove any coarse particles. (It should be mentioned at this point that some of the care outlined can be disregarded if the specimen is being prepared merely for thickness measurements. The technique outlined is intended where resolution of the *structure* of the electrodeposit is desired.)

The procedure described is followed through the various sizes of paper until 000 paper has been used. Many structures require polishing with 0000 paper and at least two lap polishings. However, in the case of hot-galvanized coatings, excellent resolution of the structure of the coatings can be made directly after polishing on 000 paper. Such coatings can be etched directly with the chromic acid-sodium sulfate etch and the three phases of the hot-galvanized coating can be clearly resolved. The technique of etching will be discussed later. In Figure 1 the various structures of a hot-galvanized coating can be clearly seen with no evidence of polishing marks in the coating. However, polishing marks can be seen in the base steel.

Wheel Polishing

Normally, polishing is done with two degrees of fineness of levigated aluminum oxide. The coarser abrasive is used on a canvas wheel and the finer is used on silk backed duvetyn or fine billiard cloth. Special aluminum oxide for metallographic polishing in various degrees of levigation is available commercially, and unless large amounts of abrasive are used, it does not pay to do levigation. If this is done, it is done by mixing the aluminum oxide with water to form a thin slurry. The addition of a surface active material such as a sulfated fatty alcohol helps to deflocculate the abrasive. The slurry is shaken in a cylinder, and after standing for a certain period of time, a portion is siphoned off and this contains the coarser particles. After allowing the slurry to settle longer, another layer is siphoned and this contains even finer particles. By varying the length of time before siphoning, various degrees of levigation can be obtained. It is based on Stoke's law that heavier particles settle out much more rapidly than finer particles.

The polishing wheel rotates slowly and the canvas is fastened to the wheel by means of a ring. Make certain that the wheel is smooth and there are no wrinkles in the canvas. Apply some abrasive from a "shaking" bottle, which is a 500 cc. flask with a one-hole rubber stopper with a somewhat restricted glass tube inserted in it. The shaking keeps the abrasive stirred up and there is little

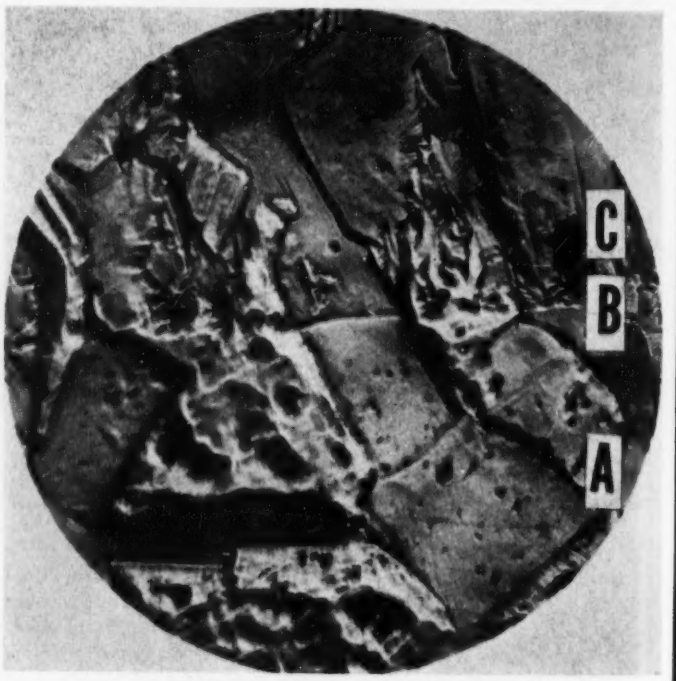

Fig. 2. Photomicrograph of an acid copper plate deposited upon etched copper. There is perfect reproduction of the structure of the base copper by the electrodeposited copper. This is an example of contrast etching. Notice the relief effect in various crystals or grains. Magnification 500x. Identification: A—base copper; B—junction; C—electrodeposited copper.

chance for contamination of the abrasive suspension.

Rotate the specimen in the direction opposite to the direction of the polishing wheel. Do not bear down heavily on the wheel because smutting and plastic flow of the specimen may occur. Apply abrasive from time to time keeping the wheel moist. Continue polishing until all of the scratches from the 0000 paper have been removed. In some cases it is advisable to etch the specimen after polishing on the first wheel and then repolish. This tends to remove worked metal. Wash the specimen and then polish on the billiard cloth wheel with the finer levigated aluminum. The specimen should then be ready for etching.

Etching

Etching is done to remove flowed metal and to bring out structural details and mechanical boundaries. Due to the electrochemical action resulting from immersion of dissimilar metals in the etching solution, simple immersion or swab etching usually results in poorly defined edges of the plate and a general dirty appearance of the coatings. Longer etching (from one to several minutes) is satisfactory for low magnifications and when plating thicknesses are to be determined. However, if the specimen is to be examined at high magnifications (greater than 100x), long immersion may destroy detail. The degree of etching has to be learned from experience. Whereas 10 seconds may be a sufficient time for etching zinc or copper in a chromic acid etching solution, an hour may be needed for etching nickel in hydrochloric acid.

Oxidizing mixtures tend to give "contrast" etching in which the crystal faces themselves are etched and in some cases etching facets are visible (see Figure 2). Non-oxidizing etchants tend to give "plain" etching in which grain boundaries and inclusions are primarily attacked.

The writer has found that the most generally satisfactory method of etching plated coatings involves pouring the etching solution on the billiard cloth lap and gently rotating the specimen in the direction opposite to that of the wheel which should be rotating very slowly. By means of this technique, clean, clear structures can be obtained.

Etchants

Copper. One of the most generally useful etching solutions for copper and copper alloys is composed of freshly mixed ammonia and hydrogen peroxide. The proportions can vary considerably and one mixture, for example, is composed of:

Ammonium hydroxide, sp. gr. 0.88	50 cc.
Water	50 cc.
Hydrogen peroxide, 30 volume (9%)	20 cc.

This etching solution tends to give a plain type etch.

For contrast etching, the writer prefers the chromic acid solution as follows:

Chromic acid	20 grams
Sodium sulfate, anhydrous	1.5 "
Water	100 cc.

Etching time with both etchants is relatively short ranging from 5 seconds to 1 minute. The chromic acid etch is much faster than the ammonia-peroxide etch.

Another etching solution that is particularly good for contrast etching is composed as follows:

Ammonium persulfate	10 grams
Water	100 cc.

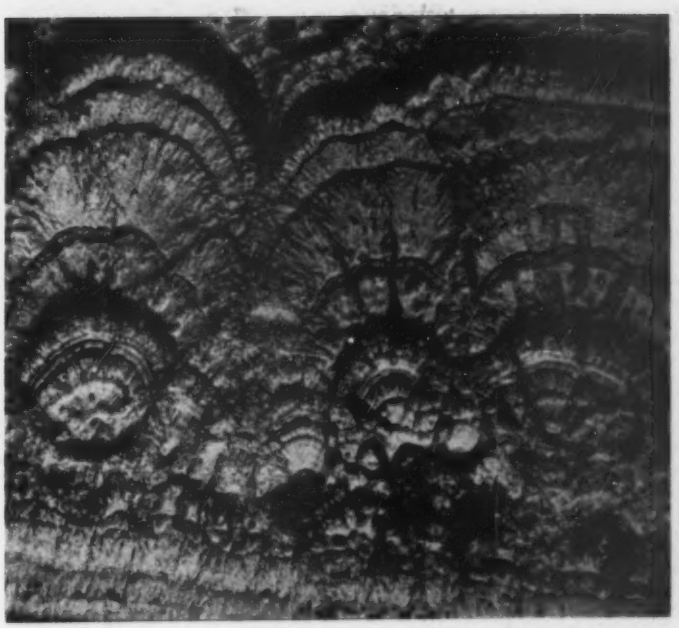

Fig. 3. Structure of a brass electrodeposit. There is a definite structure but crystals could not be resolved. The structure was largely due to the presence of inclusions. Magnification 200x.

This etchant must be made fresh each time it is used and occasionally a small amount of ammonia may make it more satisfactory. The specimen shown in Figure 2 was treated with this etch.

Zinc and Cadmium. The chromic acid-sodium sulfate etch described above is ideal for both zinc and cadmium. This etch is also excellent for hot-galvanized coatings.

Tin. Three types of etching solutions may be used for tin coatings. One is pure concentrated hydrochloric acid, another is composed of 5 cc. of concentrated nitric acid and 95 cc. of ethyl alcohol. A 5% by weight solution of ammonium persulfate is useful for differentiating between components of tin coatings on steel.

Chromium. Dilute solutions of hydrochloric acid and water or alcohol are preferred for etching heavy chromium deposits. Chromium can also be etched by making the specimen the anode in a chromium plating solution using about one ampere per square inch.

Iron. Nital is most generally useful because electroplated iron is very high purity iron. Nital is composed of 1.5 cc. of nitric acid (sp. gr. 1.42) and 95 cc. of 95% or

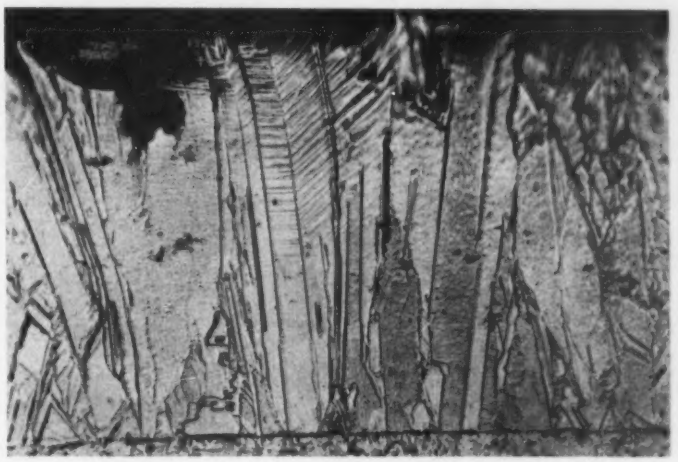

Fig. 4. Structure of an acid copper deposit which has reproduced the structure of the base metal. Notice the twinned crystal in the center of the photograph. Magnification 200x.

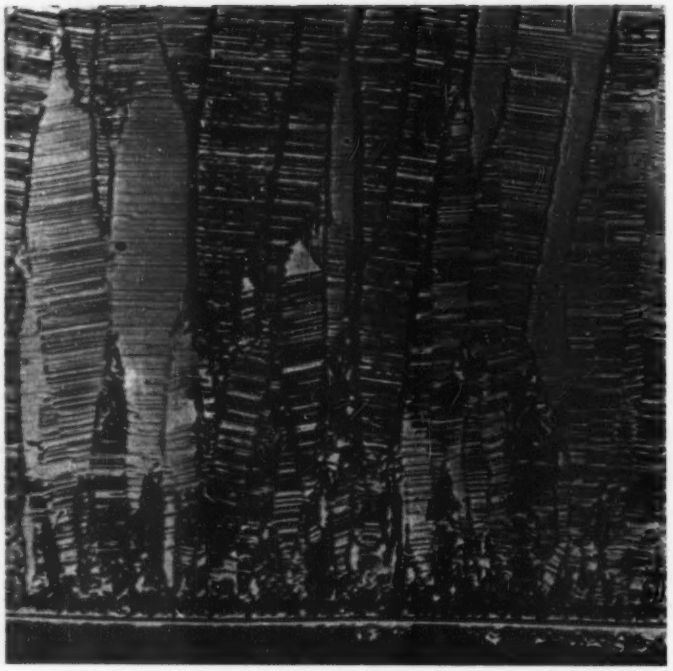

Fig. 5. Structure of a soft acid copper deposit showing pronounced columnar growth. This copper coating resulted after the purification of the acid copper with activated carbon. In this case, a small amount of organic impurities in the copper solution is needed to give a finer grain size. Magnification 100x. (Courtesy C. C. Helmle.)

absolute ethyl or methyl alcohol. Picral is also generally useful. This etchant is composed of picric acid—4 grams 95% or absolute ethyl or methyl alcohol—100 cc.

NICKEL. The structure of nickel plate is difficult to obtain. Concentrated hydrochloric acid can be used, etching from five minutes to an hour. This etchant cannot, obviously, be used with the polish-etching technique but the specimen is immersed in the acid. Another etch is:

Nitric acid	50 cc.
Glacial acetic acid	50 cc.

SILVER. Strong oxidizing type etchants are used for silver. These include the following:

Potassium cyanide	5 grams
Ammonium persulfate	5 "
Water	200 cc.

This mixture must be made up just before use as it decomposes quickly.

Another etching solution for silver is composed of an aqueous solution of chromic acid and water:

Chromic acid	0.2 gram
Sulfuric acid, conc.	0.2 "
Water	200 cc.

The ammonia-hydrogen peroxide etching solution described for copper can also be used for silver.

Microscopic Structure of Electrodeposits

Beginners in the metallography of plated coatings are inclined to see structures that do not exist or give improper interpretations to the structures. The structures of almost all deposits from cyanide solutions, such as silver, cadmium, zinc, copper and brass, are so fine that crystals or grains cannot be seen under the highest power of the microscope and to the writer's knowledge these have not, as yet, been investigated with the electron microscope which has at least ten times greater resolving power than the optical microscope. Often structures are visible that resemble grains or crystals but close examination will not enable definite grain boundaries to be seen. Thus, for example, in Figure 3 the structure of a brass coating deposited from a cyanide solution is shown and although certain structures are visible, there is no evidence of discernible crystal structure.

The term "grain size" has been much abused in regard to its use for electrodeposits. Fineness of grain, by no means, insures the "brightness" of plated coatings. Actually, deposits with fine grain size may be rougher in appearance than deposits with much larger grain size. In coatings produced from cyanide solutions, it is preferred orientation with or without "Liesegang" structure that determines brightness. Very fine structures may be rough due to nodular growth caused by co-deposition of impurities or basic matter.

Deposits from acid solutions made in the absence of foreign organic matter or metals are usually columnar and frequently show pronounced twinning. This is beautifully shown in Figures 4 and 5 which are cross-section photomicrographs of copper deposits from acid copper solutions.

Deposits made in the presence of brighteners most frequently show banding or "Liesegang" structures (see Figure 6). These have been observed in bright nickel, copper, zinc, cadmium, cobalt and iron electrodeposits. There have been several cases of bright nickel and bright zinc coatings where the writer has been unable to develop any banded structure in spite of the use of many types of etchants and etching techniques. In the case of the zinc coatings it was indicated that the brightness was due to pronounced preferred orientation with almost perfect columnar growth of the crystals resulting in an optically flat reflecting surface.

Inclusions are common in plated coatings. These may be basic matter or from floating particles in the solution. The inclusions may be either parallel to or horizontal to the plane of the sub-strate.

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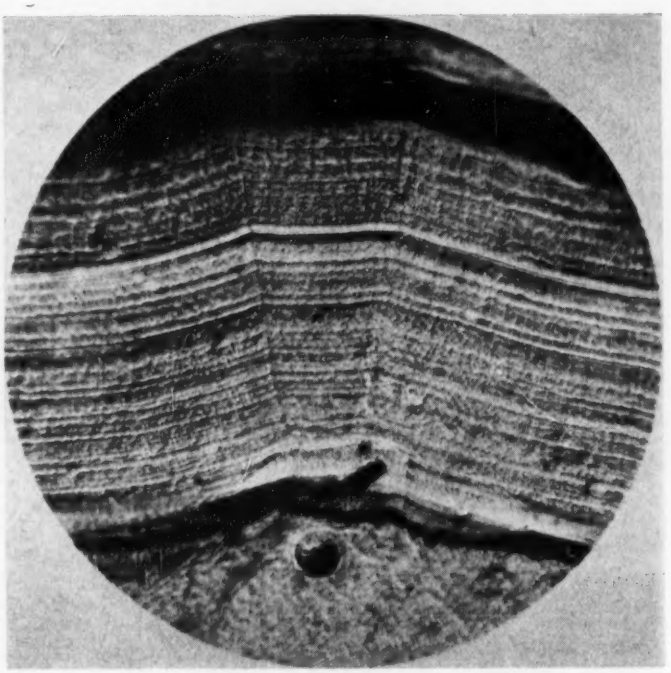


Fig. 6. Banded structure in a bright nickel deposit where no crystal structure could be resolved by the microscope. Magnification 1000x.

The Electrochemistry of Corrosion

By C. L. BULOW

Research Chemist, Bridgeport Brass Co., Bridgeport, Conn.

PART II

Galvanic Corrosion

When we were discussing the electrochemical theory of corrosion, we considered the nature of the popular dry cell where two dissimilar materials, carbon and zinc, were immersed in a common electrolyte. The coupling of zinc with iron, nickel, copper, gold and other elements would produce similar results. For example, if zinc is coupled to iron in salt water, the zinc becomes anodic (corrodes) and the iron cathodic (protected). On the other hand, if iron is coupled to copper and the couple is placed in salt water containing dissolved oxygen, the iron becomes anodic and the copper cathodic. In terms of the electrochemical theory of corrosion, the anodic reaction may be represented as $Fe \rightarrow Fe^{++} + 2e$ and the cathodic reaction as $2H^{+} + 2e \rightarrow 2H$, and $2H + O \rightarrow H_2O$. These reactions are identical to reactions 2, 3 and 8.

Here again the oxygen supply is one of the important factors. This also suggests that the rate of corrosion might be dependent upon the relative cathodic and anodic areas. Numerous investigations indicate that this is so; that is, the larger the cathodic area, the more intense will be the rate of corrosion of the anodic material. For example, in the following three diagrams, A, B, and C (Figure II) which represent three pieces of iron plate, two of which are partially coated with copper, we have varied the size of the cathodic area as desired.

If these three pieces of metal were submerged in a salt water solution containing dissolved oxygen and the extent of corrosion measured after a certain time interval, it would be found that all specimens had suffered the same total loss in weight. However, the intensity or depth of corrosion in specimens B and C would vary with the relative sizes of the cathodic and anodic areas. Since the anodic area of C is approximately one half the anodic area of B, specimen C would corrode at a rate approximately two times that of B. This means primarily that the effect of the galvanic couple consists in increasing or localizing a corrosion which in a given environment would have occurred whether the dissimilar metals were connected or not. It also means that one member of the couple becomes cathodic and the other anodic. If the cell does not consist of two dissimilar metals in electrical contact (Specimen A), then generally the development of localized areas of corrosion is largely a matter of chance.

It is evident that the coupling of copper and copper base alloys to iron and other less noble metals would decrease the rate of corrosion of the copper and would tend to increase the rate of corrosion of iron. The magnitude of this effect depends upon the nature of the corrosive medium and the arrangement of the various members constituting the couple. It also means that a large area of a less noble metal in contact with a small area of a more noble metal will have about the same corrosion rate as it would if the more noble metal were absent, but a small area of a less noble metal in contact with a large area of a more noble metal will suffer from very rapid corrosion. For example, generally a brass fitting in an iron pipe line will do relatively little to accelerate the corrosion of the iron, whereas an iron fitting in a brass or copper line will frequently suffer from rapid corrosion. The areas affected in this type of corrosion are usually limited to within several inches of the point of contact.

The galvanic corrosion is further complicated by the fact that iron coupled to copper corrodes faster than when iron is coupled, for example, to nickel. Apparently, this occurs because oxygen reacts more rapidly with the hydrogen which accumulates on the cathodic copper surface: Reaction (8) $2H + O \rightarrow H_2O$. The potential difference between iron and copper is also greater. Yet, on the other hand, if oxygen is absent, and the hydrogen ion concentration is sufficiently high to permit the evolution of hydrogen (reaction 7), then iron coupled to nickel will corrode faster than when iron is coupled to copper and in the former instance the potential of the iron-nickel couple will be higher. If the potential difference between two metals is close together, the behavior of the couple will vary according to the solution in which it is placed. Several investigators have reported on the behavior of various types of couples in various media.

This work on galvanic cells has shown that cathodic protection of metals is feasible and successful. In practice this is accomplished, for example, by the sacrificial protection of iron by zinc and cadmium or by an imposed potential whereby the normally corroding metal is maintained artificially as the cathode. This must be done with caution since certain metals may under some conditions be corroded more rapidly by the alkali which normally forms in the cathodic area. (See curve on "Effect of pH on

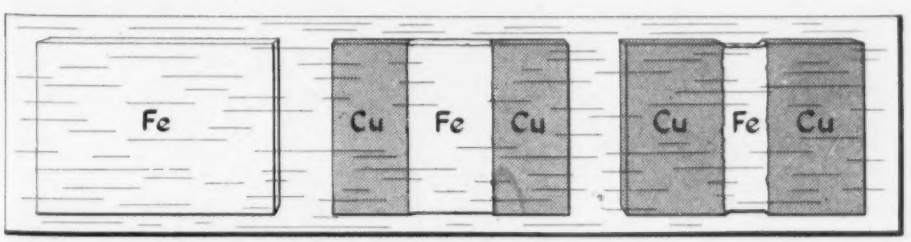


Fig. II. Effect of variation in size of cathodic area on extent of corrosion.

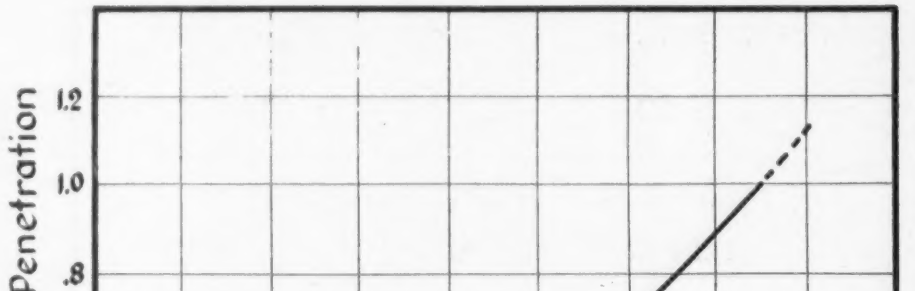


Fig. III. Effect of temperature on rate of corrosion of brass in 3% salt solution.

the Corrosion Rate of Metals", Sept. issue).

This galvanic action does not occur when dry, dissimilar metals are in contact. It is for this reason that iron hangers can be used with impunity to support copper and brass pipe and in all sorts of mechanical devices which employ several dissimilar metals which normally operate in the presence of air or oil.

Influence of Temperature

Before going into a discussion concerning the influence of water compositions upon the corrosion rate of metals, it is well to recall that heat accelerates practically all of the reactions involved. Qualitatively, it may be said that a temperature rise of the corroding solution of about 20°C. will double the rate of corrosion. The effect of temperature is not always as pronounced as this and sometimes it is more pronounced. This change in corrosion rate with temperature depends upon the nature of the corroding medium. The curve in Figure III gives an indication of the effect of temperature on the relative corrosion rate of brass in a 3% sodium chloride solution.

One of the reasons that many power plant engineers keep a record of incoming and outgoing condenser waters is because it is realized that a unit operating at too high a temperature will fail prematurely. The higher temperature of cooling waters during the summer of the year is also one of the factors contributing towards more rapid corrosion during this season. It is a common experience to have considerably more trouble with hot water lines and storage tanks than with cold water installations.

Sometimes, in certain waters, the corrosion rate of a metal drops off with an increase in temperature. Such a water may at higher temperatures deposit a constituent which is less soluble at elevated temperatures. Calcium carbonate is one of those minerals which deposits in pipe lines handling hot and cold hard waters. Frequently, calcium carbonate forms as a result of the decomposition of more soluble calcium bicarbonate at elevated temperatures which also produces some carbon dioxide:

$$Ca(HCO_3)_2 \xrightleftharpoons{\text{heat}} CaCO_3 + H_2O + CO_2$$

If a continuous deposit of calcium carbonate forms, it may completely protect the underlying metal, and yet, if breaks occur in this type of an impervious mineral scale, pitting is likely to take place at these exposed areas.

Unfortunately, the build up of a thick mineral scale on the inside of a water heating coil, boiler, condenser tube, etc., seriously interferes with heat transfer. This loss in heat transfer results in considerably higher temperatures on the metal surfaces facing the fire which, in turn, leads to more rapid oxidation of the metal (such failures are described as resulting from "overheating" or actual "burning"); in this instance, direct combination of the metal with oxygen takes place: $2M + O_2 \rightarrow 2MO$, without the steps involved when metals corrode in water solutions.

Influence of Water Composition on Corrosion Rates

The corrosiveness of water depends in a complicated manner upon the concentration of mineral matter, gases, organic matter and debris, some of which are tabulated below.

The sum of all the cations and anions gives the total mineral content of the water. Space does not permit a detailed discussion of the complicated interaction of very many of these substances upon the corrosion rates of metals. This belongs in the field of water chemistry.

The influence of the hydrogen ion (H^+), pH, has been studied in great detail and has been found to vary depending upon the metal being corroded and upon the concentration of all the other materials present. Generally, an increase in the concentration of hydrogen ions accelerates the rate of corrosion of a metal.

pH Defined

The pH value is in a sense misleading since a low pH value indicates a high concentration of hydrogen ions (H^+) and likewise, a high pH value indicates a low concentration of hydrogen ions. This is understood better when it is remembered that, mathematically expressed, the pH is equal to the logarithm of the reciprocal of the

Water Composition Data

Cations	*Anions*	*Gases*	*Organic Matter*	*Debris*
Na^+	OH^-	O_2	Colloids	Silt
Ca^{++}	$CO_3^=$	CO_2	Phenol	Sand
Mg^{++}	HCO_3^-	H_2S	Coloring matter	Leaves
K^+	$SO_4^=$	SO_2	Oil & fats	Seaweed
H^+(pH)	NO_3^-	SO_3	Bacteria	Coal dust
Fe^{+++}	Cl^-	NH_3	Decomposing refuse	Coke
Cu^{++}	$PO_4^{\equiv}$	Cl_2	Inhibitors	Refuse

hydrogen ion concentration in terms of gram equivalents per liter of solution. pH = log. (1/H). It is obvious from the table in Figure IV that the pH scale is much more convenient to use than Normality.

Pure water dissociates or breaks up to a very slight degree according to the equation $H_2O \rightleftharpoons H^+ + OH^-$ so that it contains 1/10,000,000 gram equivalent of hydrogen ion per liter which is 1/100,000,000 per cent of hydrogen ion by weight. This also means that pure water containing 10^{-7} (pH 7.0) gram equivalents of H^+ must of necessity contain an equal quantity of hydroxide ions (OH^-). The product of these two quantities (the dissociation constant) is always the same $10^{-7} \times 10^{-7} = 10^{-14}$ at 25°C. Therefore, if the concentration of hydrogen ions is 10^{-5}, the concentration of hydroxide ions must be 10^{-9}. The pH of 7.0 for water is also called the neutral point and water solutions with pH values below 7.0 have acidic properties while water solutions with pH values above 7.0 display basic properties. Exposure of pure distilled water to air, which contains approximately 0.04% carbon dioxide, lowers the pH to about 6.0 or lower; this represents a tenfold increase in hydrogen ion concentration. Rain water has a pH of 6.0, acid swamp water a pH of 5.0, soda water (water charged with carbon dioxide) a pH of 3.8.

Since the reaction of a metal with water solutions can also be expressed as a simple displacement reaction:

Metal Atom + Hydrogen Ion → Metal Ion + Hydrogen Atom

$$M + H^+ \rightarrow M^+ + H,$$

it is evident that where a greater number of hydrogen ions (low pH) is available, the corrosive reaction should occur more rapidly; within the lower pH range this is so as shown in the following Corrosion Rate vs. pH Curve (Figure V).

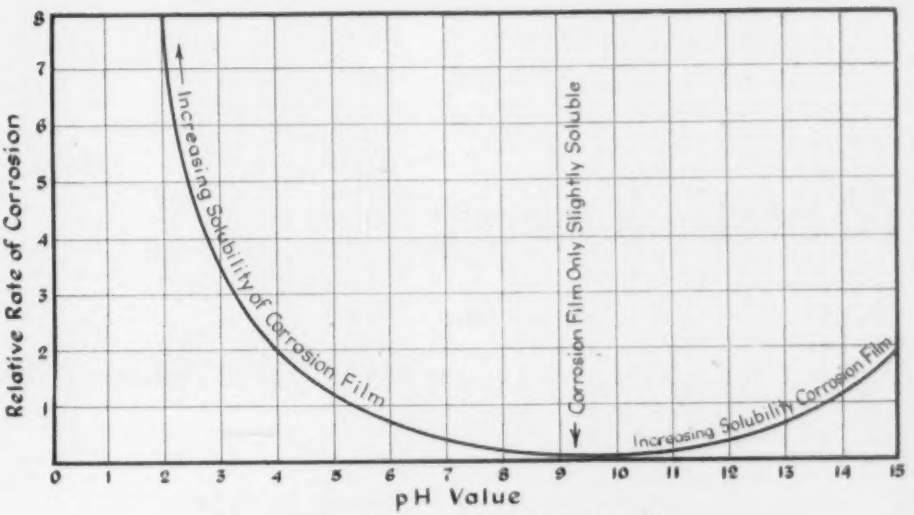


Fig. V. Effect of pH on corrosion rate of metals.

The general shape of this curve may be considered as approximately typical for such metals as iron, copper, etc. Such curves prepared for various metals and alloys would have their minima broadened or shortened, the slopes varied considerably and the whole curve displaced in any direction depending upon the characteristics of the alloy and the composition of the solution.

It should be noticed that corrosion is taking place when the pH is 7.0 or higher. This means that even though the hydrogen ion concentration is extremely low at pH values at and above 7.0, nevertheless there are enough hydrogen ions available for the reaction to proceed and that as hydrogen ions are being removed more are being continually formed ($HOH \rightleftharpoons H^+ + OH^-$) to replace those used in the corrosion reaction. However, if the corrosion takes place in a closed system, the pH will gradually rise and may tend to stifle the reaction because (1) the corrosion film may be less soluble at the

(*Concluded on page* 656)

Relation Between Hydrogen Ion Concentration and pH Value

Concentration of Hydrogen Ions in Solution (Activity)		*pH Value*
1.39	Normal*	—0.14
1.00	"	0.00
0.80	"	0.10
0.44	"	0.36
10^{-1}	"	1.0
10^{-2}	"	2.0
10^{-3}	"	3.0
10^{-4}	"	4.0
10^{-5}	"	5.0
10^{-6}	"	6.0
10^{-7}	"	7.0
10^{-8}	"	8.0
10^{-9}	"	9.0
10^{-10}	"	10.0
10^{-11}	"	11.0
10^{-12}	"	12.0
10^{-13}	"	13.0
10^{-14}	"	13.6
10^{-14}	"	13.9
10^{-14}	"	14.0
10^{-14}	"	14.1

increasing basicity ⇅ *increasing acidity*

* Normal, i.e. gram equivalents per liter.

Examples

Hydrochloric	acid	2.0	Normal,	i.e.	7.1% by wt.	72.94 g./L.
"	"	1.2	"	"	4.3	43.70
"	"	1.0	"	"	3.6	36.47
"	"	0.5	"	"	1.8	18.22
"	"	0.12	"	"	0.44	4.37
"	"	0.01	"	"	0.036	0.364
"	"	0.001	"	"	0.0036	0.036
"	"	0.0001	"	"	0.00036	0.0036
"	"	0.00001	"	"	0.000036	0.00036
Pure Water						
Sodium	hydroxide	0.00001	Normal,	i.e.	0.000040	0.00040
"	"	0.0001	"	"	0.00040	0.0040
"	"	0.001	"	"	0.0040	0.040
"	"	0.01	"	"	0.040	0.40
"	"	0.12	"	"	0.48	4.80
"	"	0.5	"	"	2.0	20.00
"	"	1.0	"	"	3.8	40.01
"	"	1.2	"	"	4.6	48.00
"	"	2.0	"	"	7.4	80.02

Fig. IV.

Metal Spraying

Solves a Finishing Problem

By R. C. OVERSTREET

Tinnerman Products, Inc., Cleveland, Ohio

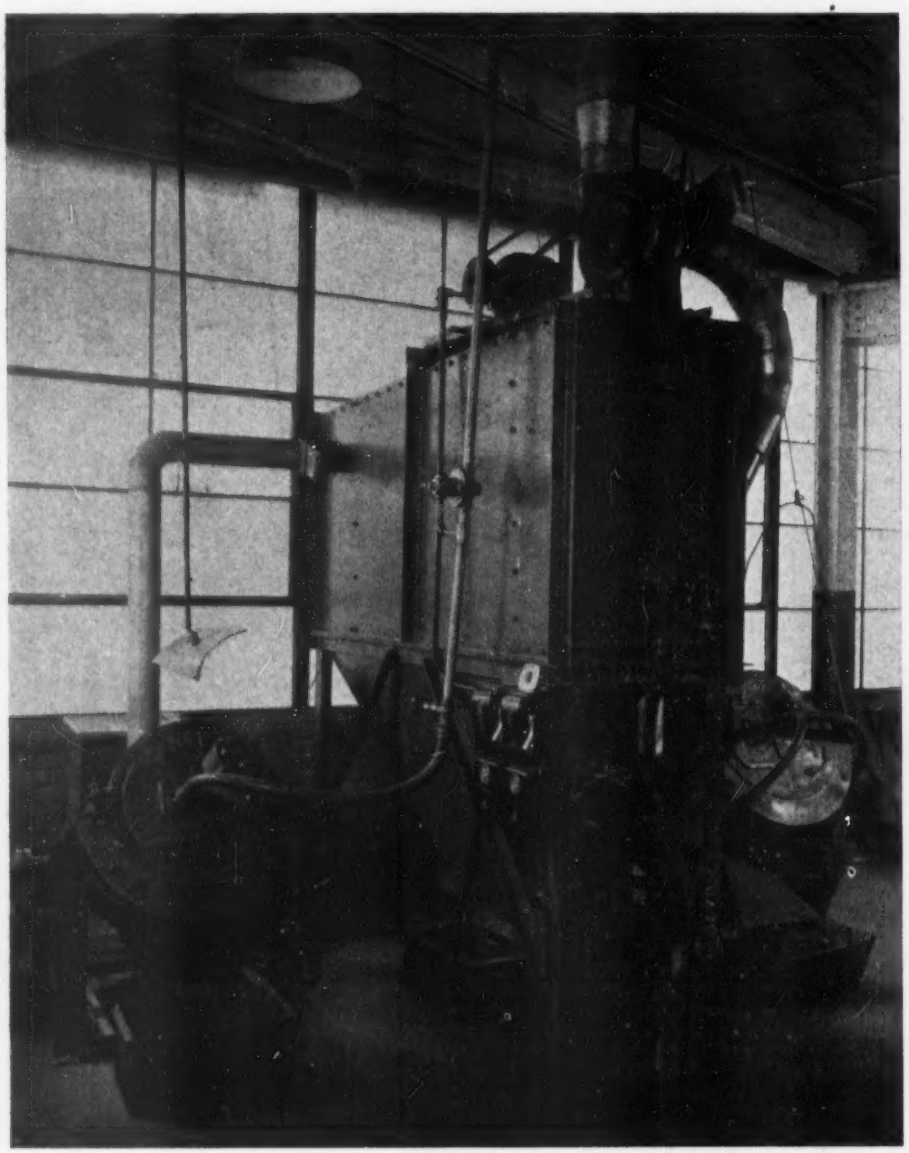


Fig. 1. Speed Nuts are first grit blasted in tumbling barrels.

One of the vexing problems confronting the plater today is the production of protective metal coatings on high carbon spring steel without hydrogen embrittlement. The following is one successful answer which will probably have wide application in the future.

SPEED Nuts for aircraft are manufactured to U. S. Army Air Force Specification number 25533 for Nuts, Sheet Spring, and are approved for use in most all non-structural attachments for military aircraft.

The basic flat type Speed Nut as illustrated in Figure 2, is an arched spring steel stamping with integral prongs formed to fit the helical pitch of screw threads. As the screw is tightened, the main arch of the Speed Nut is flattened, forcing the prongs deeper into the root of the thread, thus giving a firm spring lock. The Speed Nut is the only self-locking nut which provides an arched spring lock and an inward thread lock at the same time.

Former Method of Protection

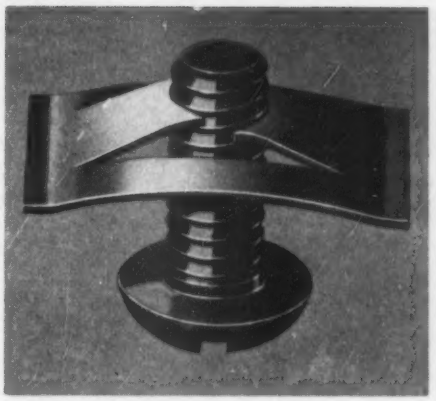
Prior to the war, Speed Nuts were furnished with a salts hard blue finish. Where rust-proofing was necessary, a thin coating of cadmium, zinc, or lacquer was applied. With the coming of the war and curtailing of domestic

(Photographs courtesy of Metallizing Engineering Co., Inc., Long Island City, N. Y.)

production, Speed Nuts were accepted by the aircraft industry, which consumed the greatest volume of the output. The thin coating of cadmium suitable for pre-war production would not give the necessary rust-proofing qualities demanded by Air Corps specifications, so it became necessary to plate them with cadmium .0005" thick to AN-QQ-P-421 specifications.

Usual Baking Too Slow

Practically all Speed Nuts are made from high carbon spring steel, which in the plating process absorbs hydrogen causing hydrogen embrittlement, a phenomenon peculiar to the plating of this type of steel. To release this imprisoned hydrogen, it was necessary to bake the Speed Nuts in an oven for 20 hours, a process that was too lengthy to use in fulfilling the increasing demands for production by the aircraft industry.



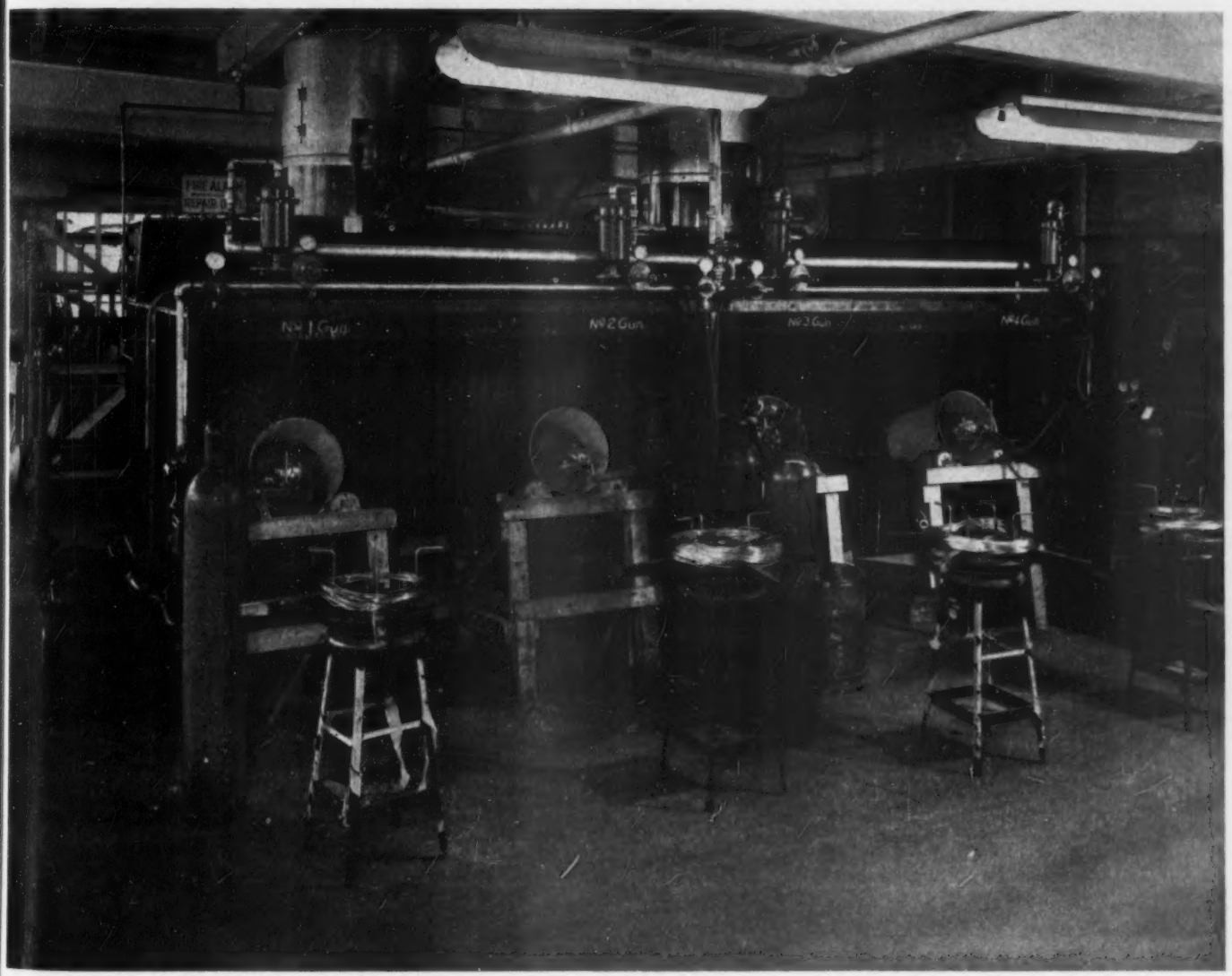
(Above) Fig. 2. Basic Speed Nut

Paint Finish Limitations

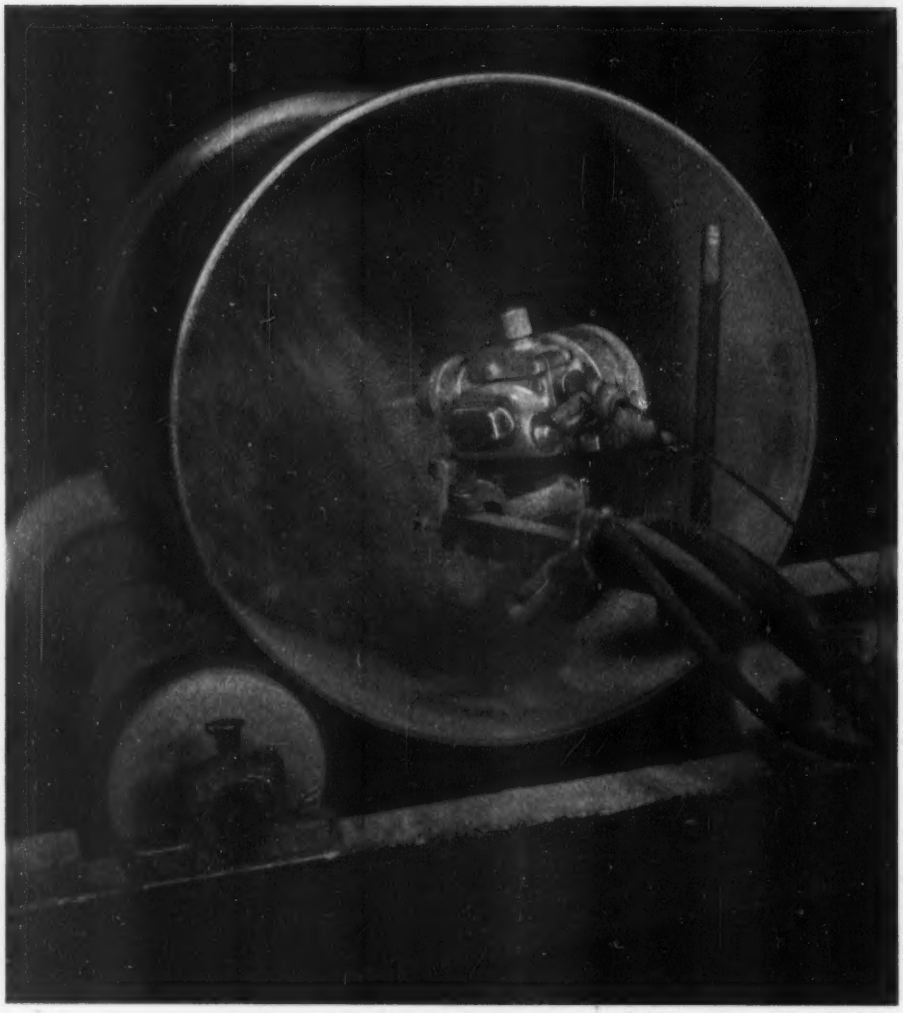
The first attempt to alleviate this problem was the development of a painted finish. This finish consists of Parkerizing the Speed Nuts, followed by two coats of zinc chromate primer. This finish met specifications of both the Army Air Force and the Bureau of Aeronautics and is an excellent coating. However, where electrical bonding was necessary, this finish could not be used as it had a tendency to insulate and would not conduct electricity. A finish which was an electrical conductor was necessary.

Metallizing Meets All Needs

It was then that metallizing was turned to as an answer to this finishing problem. Preliminary tests were conducted which were very satisfactory. A high degree of rust-proofing was obtained in a minimum amount



(Below) Fig. 3. Production metallizing setup for coating Speed Nuts. Four Metco Type 2E guns operate automatically and continuously in turning out millions of these corrosion resistant devices.



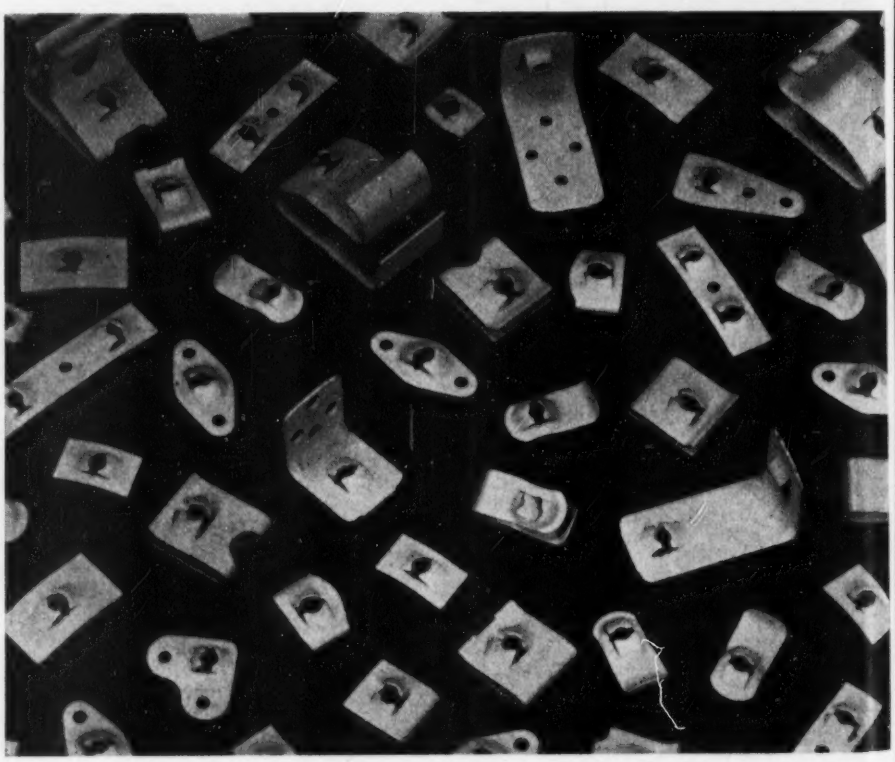
(Above) Fig. 4. Close-up of metallizing operation.

(Below) Fig. 5. Various types of parts finished by metal spraying.

of time. The only existing problem now was a means of applying the metallized finish on a production basis. Large quantities of small parts had never been metallized before. After several weeks of development work, a process was evolved in which several hundred thousand Speed Nuts are metallized each day.

Procedure Developed

After the Speed Nuts are heat treated to the proper degree of hardness, they are sand-blasted with steel grit in sand-blast tumbling barrels, to roughen the surface so that the metallized finish will adhere. (Figure 1.) The Speed Nuts are then placed in wire mesh baskets and set on revolving rollers which turn the basket at approximately 24 revolutions per minute in a cascading motion in the bottom of the basket. Zinc is then sprayed on for approximately five to six minutes, giving each Speed Nut a zinc finish approximately .0005" thick. (Figures 3 and 4.) The spray guns are run continuously. When one basket of Speed Nuts is finished there is another waiting to be set on the rollers. The whole spraying operation is carried on in a water wash spray booth (Figure 3), so that all the zinc that does not adhere to the Speed Nuts is precipitated into the water trough and reclaimed.



High Speed and Resistance

The zinc metallizing process is complete in less than one hour, as compared to 20 hours for one operation alone under the previous method of cadmium plating. Also, standard salt spray tests (AN-QQ-S-91) conducted to determine the rust-proofing qualities of this finish, show a lapse of approximately 350 hours before breakdown, whereas the cadmium plating would only withstand approximately 250 hours.

Passed 65,000,000 Mark

To date approximately 65,000,000 Speed Nuts have been finished by this process with greater resistance to rust and corrosion than ever before and tremendous savings of time. Although this process was developed during the rush of war-time production, it is believed it will have definite value in post-war times.

THIS IS WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

Metal Finishing Cost Problem If one asks some operators of jobbing metal finishing shops if they know how much it costs them to do business, they may think you are a lunatic who has escaped from some institution because over the doors of their establishments they may have a sign which reads: "The Golden Horn Electroplating Works, Established in 1895." They think a sign like that should be proof positive that they know a thing or two about metal finishing costs. Have they not been in continuous business for 48 years in the same place?

Cost Record Methods If they think you are harmless, press them further by asking what they mean by the terms "costs" and "profits". Some may turn to their desks which are covered with everything from lodge pins to candlesticks left with them for refinishing. Unlocking drawers stuffed full of bills, receipts, letters and other papers, they search for a book which they use to record their business transactions. On one page of this book, perhaps for income tax purposes, they record in columnar form their total weekly receipts and expenditures.

What Are Profits? At the bottom of the two columns they probably subtract their expenditures from their receipts. This they may tell you is their profits. Ask some of them to name some of the items which they exclude from their expenditures and some may boast that they do not have to include rent because they own the property they occupy. Do not ask some of them if they include depreciation, obsolescence and interest on working capital requirements in their expenditures because that may embarrass them for the reason that such deductions would result in a shrinkage, or perhaps a complete disappearance, of their profits.

Just Bookkeeping Go into some other shops and these firms may have good bookkeeping systems, but no cost accounting system. Perhaps the only ones which really know anything about costs are the large metal finishing establishments and the big corporations which have metal finishing divisions.

Estimating Those metal finishing establishments which lack a cost finding system do not know the true cost to perform a particular metal finishing operation. As a result, a lot of guessing is done when it comes to estimating. And a lot of it is wrong guessing.

Danger of Guessing The firms which guess too low earn little or no profits, and the ones which guess too high are in constant danger of losing business. It is also hazardous to submit estimates based on the costs and prices of other metal finishers for the reason that no two finishers have the same cost experiences because of differences in operation, kinds and conditions of equipment, efficiency of workmen and supervisors, sizes of plants, and methods of soliciting business.

Cost of Each Operation Required Before metal finishers can accurately estimate with full justice to themselves on a particular kind of service, they must know the costs of all phases of operation of different kinds of jobs. And this requires a clear understanding of the term "costs".

Indifference on Costs Observation tells one that the term "costs" means different things to different persons because of prejudice, carelessness, indifference, or ignorance, or a combination of two or more of these and other causes.

Direct and Indirect Costs The term "costs", as used here, means all direct and indirect costs. Direct costs are those expenses which can be easily identified with a specific job or service such as the cost of materials and labor. Indirect costs are those expenditures which cannot be easily allocated to a particular job or service such as depreciation, fire insurance, and administration expenses.

Constant and Variable Costs Some costs like interest on mortgages or funded debts and rent are constant costs. The variable costs consist of such items as supplies, fuel, selling costs, income taxes, and most labor costs.

Productive and Non-Productive Labor Costs The direct productive labor costs are for such operations as buffing, cleaning, coloring, dipping, drying, enameling, galvanizing, grinding, inspecting, lacquering, pickling, polishing, plating, racking, rinsing, shipping, and wiring. The direct non-productive labor costs consist of such items as timekeeping, supervising, and sweeping.

Direct and Indirect Materials Costs Not all material expenses are direct costs. For example, the costs of cleaning, plating, and polishing equipment are not direct materials costs. But the costs of metals, paints, lacquers, chemicals, and cleaning and polishing materials are direct materials costs.

Overhead Cost Distribution The distribution of the direct costs of a particular job are more easily accomplished if metal finishers have an effective materials and labor control system. The distribution of indirect, or overhead, costs are just as easy to allocate if metal finishers have a sound basis of distribution. For example, the fire insurance on the building should be apportioned according to the floor space occupied by each department. This and every other indirect expense should be allocated to each department on an hourly basis so that it can be properly apportioned to each job. The primary basis of distribution of premiums for fire insurance on supplies and equipment should be on the value of the commodities and property.

Repairs, Taxes, and Depreciation Costs Repairs, taxes, and depreciation costs on the building should be distributed on the basis of the floor space of each department.

Taxes Business income taxes, social security taxes, public liability insurance premiums, salaries of the general officers, general administration expenses and bad debts should be distributed on the basis of net service sales.

Light and Heat Costs The cost of light should be distributed on the candle power needs of each department, and the heat costs should be apportioned on the basis of cubic feet of space of each department.

Depreciation Charges Depreciation on the building should be distributed on the basis of floor space occupied by each department; but, departmental depreciation charges on equipment should be on the basis of the machinery's value. The rate of depreciation will vary with the type of building occupied and the kind of equipment used. This can be gleaned from the accompanying life table which was compiled from the latest edition of Bulletin "F" of the Internal Revenue Bureau on allowable life of property in calculating depreciation for income tax purposes. The annual amount of depreciation on the same life will vary according to the method of calculating depreciation. The most common way to calculate depreciation is by the straight line method. Other ways of determining the annual depreciation charge are such methods as the annuity method, sinking fund method, unit cost method, service output method, working hours method, and reducing balance method.

Cost System Advantages Some might now ask: "What are the advantages of a cost system?" In the first place, a real cost system is an analysis of all direct and indirect costs of every operation of metal finishing. It gives the metal finishers an accurate accounting of their cost of cleaning each type of metal surface from rust, scale, tarnish, dirt, grease, oil, lacquer, and paint. It reveals to them the cost of sand blasting, steel wire brushing, grinding, and buffing with abrasives in smoothing the surface of different types of articles made of different kinds of materials under various conditions. It is the barometer of their costs of chemicals and metals for baths and plating solutions for each type of work and for each kind of metal surface finished with lacquer, enamel and color. To put all this another way, it is a guide for the cost of each phase of preparing and finishing a particular job irrespective of the material of the article, its chemical composition, its kind of surface, its condition, its shape, and its size.

More on Cost System Advantages A cost system points out the real difference in the cost of operating two different types of equipment which perform similar operations such as still and rotary plating tanks. More than that, (1) it indicates departmental efficiency; (2) it is a means of estimating the profits on each phase of metal finishing; (3) it prevents payroll padding; (4) it is a means of determining the correct amount of materials and equipment necessary for profitable operation; (5) it ferrets out undesirable workers; (6) it is a means of materials control; (7) it is a means of job control; (8) it is essential to determine the correct service sales prices; (9) it is the basis of cost reduction, and (10) it is the foundation for reduction of preventable loses.

Cost Reduction Methods After metal finishers know the various methods of metal finishing and the cost of each phase of each method for different articles of each kind of material, they are then ready to seek ways and means of reducing their costs (a) by using possible substitute materials, (b) by changing their processing methods, (c) by installing equipment to speed-up their production and increase their profits, and/or (d) by changing their wage payment method to reduce idle labor costs and to increase the productiveness of their workers.

Objection to Cost Systems To all of this some may say: "That is all very good but we have neither the money nor the time to operate a cost system." In that case, they must then be content with their lot of increased risk and loss of justifiable profits.

Post-War Planning and Cost Systems On the other hand, those metal finishers who have a cost system are in an excellent position to do post-war profit planning and post-war service production planning. In service production planning, a cost system aids metal finishers (1) to render a specific service in the right way with the least amount of time, effort and cost, and (2) to utilize their shops and equipment on a cost and time standard basis. On the other hand, in profit planning a cost system is necessary to quote prices which assure metal finishers their fair and necessary profits. And what is more, it is the only means of determining the volume of work which is required to make a fair profit.

Equipment Life Table For cost finding purposes, the following table was compiled to aid metal finishing establishments in their determination of depreciation on the life of property as allowed by the Internal Revenue Bureau.

Item	*Life in Years*
Adding machines	10
Agitators	25
Barrels, tumbling	8
Benches	6
Blowers and fans	15
Brushing machines	15
Buffing machines	20
Burring machines	17
Cabinets and files	15
Calculators	10
Cases: display	20
Chairs: heavy	16
Cleaning machines	10
Clocks: time-keeping	10
Desks	20
Dictaphones	6
Dryers: centrifugal	20
Drying machines, continuous	15
Dust collector systems	20
Dusting machines	15
Elevators: freight	25
Enameling machines	15
Engines: Diesel and semi-Diesel	22
Engines: gas and gasoline	17
Factory: frame	25
Factory: masonry with frame interior	30
Factory: slow burning, with or without steel frame	35
Factory: masonry; brick; concrete-reinforced; steel frame	40
Fans, ventilating	15
Fire equipment, fire alarm system	25
Fire equipment, movable equipment	20
Fire equipment, sprinkler system	(same as type of structure)
Furnace: enameling	20
Furnace: porcelain	5
Galvanizing machines	18
Generators below 50 h.p. alternating current	17
Generators below 50 h.p. direct current	14
Grinding machines	15
Grinders: pigments	15
Heating system: boilers and furnaces	20
Heating system: radiators	25
Lighting system: wiring	20
Lighting system: fixtures	15
Lockers: steel	25
Lockers: wood	15
Pickling machines	18
Plating machines	15
Plumbing: all forms	25
Polishing machines	15
Safes and vaults	50
Sand blasting equipment	15
Sanders	16

Item	Life in Years
Scales: platform, dormant	25
Scales: platform, portable	20
Screens: revolving and vibrating	10
Signs	10
Spray booths, paint	15
Spraying equipment: paint	12
Tables	15
Tanks: aluminum	15
Tanks: cast iron	25
Tanks: galvanized iron	15
Tanks: lead-lined	15
Tanks: agitator	20
Tanks: caustic	20
Tanks, lacquer	20
Tanks: varnish	25
Tanks: pickling, cypress	10
Tanks: acid (wood-lined with lead)	10
Tanks: dipping	20
Tanks: steel	25
Tanks: wood	20
Tanks: wood, muriatic acid, rubber-lined	14
Trucks: lift	15
Trucks: hand	10
Typewriters	5
Vats: plating	15
Washing machines: metal	20
Air washers	20

Army Procurement Manual Issued

To enable Army procurement officers to benefit by the War Department's accumulated experience, the Army Service Force has issued a manual of procedure entitled "Pricing in War Contracts". The aim of this manual is to aid Army procurement officers in accomplishing maximum economy and efficiency in the buying of material. The manual which was prepared under the direction of the director of the purchases division, Army Service Forces, does not supplant or modify War Department Procurement Regulations or procurement instructions issued by the ASF.

Centralized Control Over Bills of Materials

To eliminate duplicate requests for Bills of Materials by the various claimant agencies, the War Production Board has established a control system. In commenting on this new system Walter C. Skuce, director of the WPB Controlled Materials Plan Division said: "The rules regarding requirements of materials data have been modified, eliminating the possibility that manufacturers will be called upon to furnish Complete Detail Bills of Materials. In any case where a Complete Detail Bill is required, it will be compiled in Washington from bills available in the various claimant agencies and WPB industry divisions as listed in the Central Bills of Materials Index File." This file will index all bills on Class B products and on certain Class A products. Claimant agencies and industry divisions are now instructed to contact the Central Index File before requesting prime consumers to submit a Bill of Materials on an end product. If a bill is available on the item, the request will not be made. If a bill is not available, the claimant agency will request material information on the Class A items involved and a listing of the Class B items in the unit terms shown on the Official Class B Product List. The new system also provides that when required bills are not available according to listings in the Central Bill of Materials Index File, WPB industry divisions will request additional bills on some Class B items.

Class A Civilian Products Interpretation

Interpretation No. 15 to CMP Regulation No. 1, issued on August 30, 1943, makes it clear that manufacturers of Class A civilian type end products, who received allotments and authorized production schedules from various claimant agencies or from WPB industry divisions, and who discover that because of labor shortage, lack of capacity, delays in material deliveries or other causes which will make it impossible to meet all authorized production schedules, are required to report the matter to the appropriate WPB industry division so that the division may furnish directions.

Consumer's Return of Allotments Directive

Secondary consumers of controlled materials who are required by CMP Regulation No. 1 to return an allotment of materials to those from whom they received them, and for whom it is impracticable to do so, may return them to the claimant agency whose symbol appears on the allotment, or to the War Production Board if the allotment bears one of the WPB symbols. This is the substance of Directive No. 26 to CMP Regulation No. 1 issued by the WPB on September 14, 1943. In making returns of allotments under this directive, Form CMP-32 "Consumer's Return of Allotments" must be used.

Controlled Materials Flow Speed-up

Walter C. Skuce, director of the Controlled Materials Plan Division of WPB, recently suggested that prime and secondary consumers of controlled materials who make allotments to their suppliers should make their allotments as soon as they are in position to do so. He observed: "Failure to place orders and make allotments promptly could interrupt the flow of materials and parts to end-product programs, resulting in inability of producers to meet delivery schedules. Secondary consumers should apply to their customers while prime consumers should apply to claimant agencies or WPB industry divisions."

Copper and Copper-Base Alloy Directive

Directive No. 29 to CMP Regulation No. 1, issued on September 15, 1943, by the WPB, provides that orders for copper and copper-base alloy controlled materials, bearing allotment numbers of the Office of Economic Warfare or the Office of Lend-Lease Administration may be accepted by brass mills, copper wire mills and copper and copper-base alloy foundries, even though the date and place of delivery are not specified.

Directive 27 to CMP Regualtion No. 1

The War Production Board issued Directive No. 27 to CMP Regulation No. 1 on September 14, 1943, for the purpose of making it clear that manufacturers of Class A products have the right to ask for allotments from their customers for the quarter in which the allotments are needed to obtain delivery of controlled materials.

Double Time Provision Sustained

The National War Labor Board ruled on September 4, 1943, that the Secretary of Labor's last ruling on the payment of double time for the seventh consecutive day of work under Executive Order 9240 is controlling for the whole period of the effectiveness of the order and not merely as of the date of its issuance. In an interpretation of the order, issued September 25, 1942, the Secretary of Labor said: "The double time provision for the seventh day of work is intended to discharge, as far as possible, work schedules which do not afford workers a day of rest in seven."

Electroplating Trend

The peace-time experience between 1899 and 1939 in plants which were primarily engaged in plating various metal articles such as automobile accessories, lighting fixtures, jewelry and musical instruments with chromium, copper, gold, nickel, silver and zinc indicates, according to census reports, that the cost of materials, supplies, fuel, purchased electric power and contract work (not including the cost of parts and replacements for equipment or construction materials), ranged from $2,400 to $12,500 per annum for the average plant. On the other hand, the value of products during the same period, which represents the receipts for electroplated articles

owned by others, and which includes selling and other overhead costs and profits, ranged from $9,000 to $49,000 per annum for the average shop. The number of wage earners ranged from the low of 1,943 workers in 1904 to the high of 8,256 workers in 1937. And the total value of products ranged from $784,000 in 1899 to $7,300,000 in 1939. Now in examining the index numbers which follow, it should be remembered that they do not include establishments which make articles and do their own plating, or who are engaged in enameling, japanning, or lacquering metals, or those engaged in the making of vitreous enameled products and galvanized goods. They merely cover the most important electroplating, plating and polishing establishments.

Index Numbers with 1927 as 100

Year	*Number of Establishments*	*Average Cost of Materials, Fuel, Contract Work, Etc.*	*Average Value of Products*
1899	302	33	27
1904	312	30	30
1909	461	33	31
1914	479	35	30
1919	515	64	82
1921	392	63	64
1923	446	74	73
1925	449	71	85
1927	419	100	100
1929	534	112	133
1931	464	76	85
1933	423	70	73
1935	553	105	100
1937	547	157	148
1939	643	141	127

Manufacturers of Class A Products Materials Interpretation Interpretation No. 16 to CMP Regulation No. 1, issued on September 11, 1943, provides that manufacturers of Class A products operating under the Controlled Materials Plan may follow one of four procedures in dealing with suppliers. This interpretation states: "(1) He may sell the material to his supplier from his own inventory. (2) He may furnish the material to his supplier on toll or processing agreement retaining title in himself. (3) He may place an authorized controlled material order for delivery to himself and transship the material to his supplier, either by sale or under toll or processing agreement. (4) He may place an authorized controlled materials order for delivery direct to the supplier." In none of these methods of procedure does the customer make an allotment, and the supplier does not have to keep any allotment records. The supplier must, however, keep records to show that he is using the material for the purpose for which it was received.

Lost or Stolen Materials Ruling The War Production Board ruled in Directive No. 28 to CMP Regulation No. 1, issued on September 14, 1943, that in the event controlled material is lost or stolen in transit, it must be replaced by the person with whom the order was placed, without requiring a new allotment. Warehouses must give preference to such replacement orders.

New MRO Pattern Established Maintenance, repair and operating supplies preference rating assigning methods under CMP Regulation No. 5 have been changed to a new pattern of relative urgency as established by the Requirements Committee on September 13, 1943. Schedules I and II of the regulation have been modified to reflect the existence of specific MRO preference rating orders which are applicable to specific industries. Directive 12 to CMP Regulation No. 5 also indicates that orders placed for MRO items prior to August 16, 1943 for delivery in the third and fourth quarters, need not be downrated in the cases of manufacturers of products, or businesses rendering services which have been moved from Schedule I to Schedule II.

Nickel Salts Wanted from Platers On September 10, 1943, the War Production Board announced a program for the purchase of idle nickel salts inventories by the Metals Reserve Company because of the urgent need for the recovery of nickel for war purposes. This program calls for the voluntary sale of idle salts by platers in order that these salts may be channelled to direct war uses. The minimum quantities purchasable under the program and the prices offered by the Metals Reserve Company are as follows:

Nickel sulfate	300 lb. or over, 11½c per lb.
Nickel ammonium sulfate	300 lb. or over, 10c per lb.
Nickel chloride	100 lb. or over, 14c per lb.
Nickel carbonate	100 lb. or over, 27½c per lb.

All of these prices are f.o.b. shipping point and apply only to commercially pure salts of standard manufacture, dry, unused and properly packed. The Metals Reserve Company has appointed the International Nickel Company to act as its agent to carry out this purchasing program. No shipments of the salts are to be made until specially instructed to do so by the Metals Reserve Company or the International Nickel Company.

Post-War Jobs and Profits On September 13, 1943 the Department of Commerce issued a profusely illustrated, 72-page booklet entitled "Community Action for Post-War Jobs and Profits, Industrial Series No. 6". This handbook outlines practical steps which local communities can take to strengthen their economic foundations in preparation for the post-war period. This simple guide aims to help local communities in assuming their responsibilities to realize full employment and aid them in finding opportunities for the post-war period. The Department of Commerce is urging all business groups to cooperate with its post-war objectives. This booklet, which is illustrated with 100 photographs and guide forms designed to help local leaders in their compilation of basic data on post-war opportunities, may be had, free of charge, from the Department of Commerce in Washington or from one of its local offices.

Price Adjustment Procedure Amended Amendment No. 4 to OPA Procedure Regulation No. 6 issued on September 1, 1943, provides for a few changes in the form used to apply for adjustment of maximum prices on commodities or services under government contracts or sub-contracts. This amendment provides (1) that selling and advertising expenses are to be separately presented; (2) costs are to be filed as of the base date of the applicable price regulation, and (3) estimated costs for the remainder of 1943 are no longer required.

Priorities Regulation No. 11B Amended Priorities Regulation No. 11B, under which some companies operate rather than under the Controlled Materials Plan, was amended on August 28, 1943. The amended regulation provides that production schedules may now be authorized for one year in advance. If priority assistance is needed to buy materials covered by WPB orders which require special applications stating the grade, quantity, size and type, then Form WPB-2613 should be used.

Quarterly Identification Symbols The quarterly identification symbol need not be shown in placing orders for Class B product components or other production materials (except controlled materials), according to Interpretation No. 14 of CMP Regulation No. 1, issued on August 25, 1943. For example, the identification "Preference Rating AA-1, Allotment Number W-1" is all that is required for the placement of an order for a Class B product. The allotment number must always be placed with preference ratings under CMP even though the quarterly identification is not required. Applications for controlled materials must include a claimant agency pattern. The quarterly identification symbol, when it is required, must immediately follow the abbreviated allotment number like this—W-1-3Q43.

Dictionary of Metal Finishing Chemicals

Hydrofluosilicic Acid: H_2SiF_6. Mol. wt. 144.08. Sp. gr. 1.29-1.34. Colorless, fuming, corrosive liquid. Also known as Sand Acid, Fluosilicic Acid, Silicofluoric Acid, Hydrosilicofluoric Acid. Decomposes when heated. Soluble in water. Slightly soluble in alkalis. Grades: Technical, C. P. Containers: Wax Bottles (1, 5 lb.); Carboys (10 gal.); Kegs (35%-100 lb.); Barrels; Tank Cars.

Hydrogen Bromide: See Hydrobromic Acid.

Hydrogen Chloride: see Hydrochloric Acid.

Hydrogen Cyanide: See Hydrocyanic Acid.

Hydrogen Dioxide: See Hydrogen Peroxide.

Hydrogen Fluoride: See Hydrofluoric Acid.

Hydrogen Iodide: See Hydroiodic Acid.

Hydrogen Nitrate: See Nitric Acid.

Hydrogen Peroxide: H_2O_2. Mol. wt. 34.0160. Sp. gr. 1.46. M. P. —1.7°C. B. P. 152°C. Colorless liquid sold in solution form. Also known as Hydrogen Dioxide, Peroxide. Infinitely soluble in cold water. Decomposes in hot water. Soluble in alcohol. Grades: Technical, U. S. P., C. P., 10 vol. (3%); 17 vol. (5%); 25 vol. (7.5%); 100 vol. (30%). Containers: Glass and Wax Bottles (1, 4, 8, 16 oz.; 5 lb.); Jugs (1 gal..); Carboys (45, 100, 120 lb.); Drums (50, 240 lb.); Barrels (380 lb.).

Hydrogen Sulfide: H_2S. Mol. wt. 34.08. Sp. gr. 1.190. M. P. —83°C. B. P. —62°C. Colorless, poisonous, inflammable gas with odor of rotten eggs. Also known as Sulfuretted Hydrogen and Hydrogen Sulfuret. Slightly soluble in water. Very slightly soluble in alcohol. Soluble in carbon disulfide. Grades: Technical. Containers: Steel Cylinders (½, 3, 9, 22, 50, 125 lb.).

Hydrogen Sulfuret: See Hydrogen Sulfide.

Hydrosilicofluoric Acid: See Hydrofluosilicic Acid.

Hydroxybenzene: See Phenol.

Hydroxybenzol: See Phenol.

These pages comprise the tenth installment of the dictionary of chemicals used in the finishing industry.

This feature will continue to be a regular part of *Metal Finishing* until all related materials have been reviewed in alphabetical order.

2-Hydroxypropanoic Acid: See Lactic Acid.

Hydroxypropionic Acid, Alpha: See Lactic Acid.

Hydroxytoluene, Meta: See Cresol, Meta.

Hydroxytoluene, Ortho: See Cresol, Ortho.

Hydroxytoluene, Para: See Cresol, Para.

Hypo: See Sodium Thiosulfate.

Hypochlorite of Lime: See Calcium Hypochlorite.

Indium: In. At. wt. 114.76. Sp. gr. 7.31. M. P. 155°C. B. P. 1450°C. Tetragonal, silvery white, soft metal. Insoluble in water. Soluble in acids. Very slightly soluble in caustic soda. Grades: Technical, Purified.

Indium Chloride-Tri: $InCl_3$. Mol. wt. 221.13. White, deliquescent plates. Sublimes when heated to above 400°C. Very soluble in water. Slightly soluble in alcohol. Grades: Technical. Containers: Glass Bottles.

Indium Cyanide: $In(CN)_3$. Mol. wt. 192.81. White precipitate. Unstable in water solution. Soluble in cyanides. Very slightly soluble in alkalis. Insoluble in acids. Grades: Technical. Containers: Glass Bottles.

Indium Sulfate: $In_2(SO_4)_3$. Mol. wt. 517.70. Sp. gr. 3.44. Grayish or white hygroscopic powder. Soluble in cold water. Very soluble in hot water. Grades: Technical. Containers: Glass Bottles.

Infusorial Earth: See Diatomaceous Earth.

Iodic Acid: HIO_3. Mol. wt. 175.93. Sp. gr. 4.629. M. P. 110°C. Colorless, rhombic crystals or yellowish crystalline powder. Solubility, 286 at 0°C. and 472 at 80°C. Soluble in alcohol. Grades: Technical, C. P. Containers: Bottles (1 lb.); Cans.

Iodine: I_2. Mol. wt. 253.84. Sp. gr. 4.93. M. P. 114°C. B. P. 183°C. Purplish black plates or flat crystals with metallic luster. Volatile and corrosive. Very slightly soluble in water. Soluble in alcohol, ether, chloroform, potassium iodide solutions, carbon disulfide. Grades: Crude, Technical, U. S. P., C. P. Resublimed. Containers: Bottles (1, 4 oz.; 1, 5 lb.); Jars (5, 10, 25, 50 lb.); Kegs (100, 200 lb.).

Iodine Tincture: Solution of iodine and potassium iodide in alcohol.

Iridium: Ir. At. wt. 193.1. Sp. gr. 22.421. M. P. 2350°C. Very heavy silvery white metal, granules, powder. Insoluble in water. Insoluble in any single acid. Very slightly soluble in boiling aqua regia. Grades: Technical. Containers: Bottles (1 g.); Boxes.

Iron: Fe. At. wt. 55.85. Sp. gr. 7.86-7.88. M. P. 1535°C. Cubic, silvery metal; filings—20, 40 mesh; powder. Rusts on exposure to moist air. Insoluble in water. Soluble in acids. Insoluble in alkalis, in concentrated sulfuric acid and in fuming nitric acid. Grades: Technical, U. S. P., C. P., Hydrogen reduced. Containers: Bottles (1, 5 lb.); Cartons; Barrels (filings—550 lb.).

Iron Alum: See Ferric Potassium Sulfate.

Iron Carbonate, Precipitated: See Ferric Oxide, Brown.

Iron Dichloride: See Ferrous Chloride.

Iron Ethiops: See Ferric Oxide, Black.

Iron Monosulfide: See Ferrous Sulfide.

Iron Oxide, Magnetic: See Ferric Oxide, Black.

Iron Perchloride: See Ferric Chloride.

Iron Pyrite: A natural ferrous sulfide, q. v. Also known as Fool's Gold.

Iron, Salts of: See Ferric and Ferrous.

Iron Sesquichloride: See Ferric Chloride.

Iron Subcarbonate: See Ferric Oxide, Brown.

Iron Sulfuret: See Ferrous Sulfide.

Iron Vitriol: See Ferrous Sulfate.

Abbreviations: Mol. wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than Technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary.

Isopropyl Alcohol: $CH_3CHOHCH_3$. Mol. wt. 60.094. Sp. gr. 0.7854. M. P. —88.5°C. B. P. 82.3°C. Colorless liquid. Also known as 2-Propanol, Dimethylcarbinol. Infinitely soluble in water, alcohol, ether. Grades: Technical; Purified 91, 98-99, 99+%. Containers: Bottles (1 lb.); Cans (1 pt.; 1, 5 gal.); Drums (50 gal.); Tank Cars.

Kaolin: High purity clay with high fusion point and white color when burned. Also known as China Clay, Porcelain Clay. See Fuller's Earth.

Kerosene: A refined petroleum distillate from which gasoline and naphtha have been removed. Flash point above 73°F. and gravity above 44°. Colorless liquid. Inflammable.

Kieselguhr: See Diatomaceous Earth.

Lactic Acid: $CH_3CHOHCOOH$. Mol. wt. 90.078. Sp. gr. 1.249. M. P. 18°C. B. P. 122°C. Colorless, hygroscopic syrup or slightly yellow heavy liquid. Also known as Alphahydroxypropionic Acid, 2-Hydroxypropanoic Acid. Infinitely soluble in water, alcohol, ether. Grades: Technical; U. S. P.; C. P., 44, 50, 75, 80, 85%. Containers: Bottles (1, 5 lb.); Demijohns (1, 5, 25 lb.); Carboys (120-125 lb.); Barrels (450 lb.).

Lactobiose: See Lactose.

Lactose: $C_{12}H_{22}O_{11}\cdot H_2O$. Mol. wt. 360.312. Sp. gr. 1.525. White crystals or powder. Sweet taste. Also known as Milk Sugar, Lactobiose. Decomposes when heated. Soluble in water. Insoluble in alcohol and ether. Grades: Technical, U. S. P. powder, C. P. powder or crystals. Containers: Bottles (1, 5 lb.); Cartons.

Lanolin: Wool fat. Also known as Adeps Lanae, Hydrated and Anhydrous Fat. Grades: Technical, Refined, U. S. P. Containers: Tins (1, 5, 100 lb.); Drums (100, 400-440 lb.).

Lead: Pb. At. wt. 207.21. Sp. gr. 11.344. M. P. 327.5°C. B. P. 1613°C. Silvery, blue white, soft, ductile, heavy metal in form of bars, granules, sticks, rods, powder, foil, sheet or shot. Insoluble in water. Soluble in nitric acid, hot concentrated sulfuric acid. Slightly soluble in hydrochloric acid, chloride solutions, alkali solutions. Grades: Chemical (not desilverized); Soft (+99.5% pure); Hard (containing antimony); Corroding (purified for white lead manufacture); Test (silver, gold and bismuth free); C. P. Containers: Cartons; Bottles (1, 5 lb.); Cases (100 lb.).

Lead Acetate: $Pb(C_2H_3O_2)_2\cdot 3H_2O$. Mol. wt. 379.35. Sp. gr. 2.55. M. P. 75°C. B. P. 280°C. Monoclinic white crystals or grayish lumps, flakes, powder or granules. Also known as Sugar of Lead. Solubility, 45 at 15°C. and 200 at 100°C. Insoluble in alcohol. Grades: Technical, U. S. P., C. P. crystals, powder or granules. Containers: Bottles, Cartons (1, 5 lb.); Cans (1, 10, 25 lb.); Boxes (25, 50, 100 lb.); Drums (100 lb.); Kegs (100, 125 lb.); Barrels (440, 500, 650 lb.).

Lead, Black: See Graphite.

Lead Carbonate, Basic: $2PbCO_3\cdot Pb(OH)_2$. Mol. wt. 775.67. Sp. gr. 6.14. White, amorphous powder. Also known as White Lead, Lead Subcarbonate, Lead Flake. Decomposes when heated. Insoluble in water. Slightly soluble in water containing carbon dioxide in solution. Soluble in acids and alkalis. Grades: Technical, Purified, C. P. Containers: Cartons (1 lb.); Bottles (1, 5 lb.); Kegs (12½, 25, 50, 100 lb.); Barrels (350, 500-600 lb.).

Lead Chloride: $PbCl_2$. Mol. wt. 278.12. Sp. gr. 5.85. M. P. 500°C. B. P. 950°C. Rhombic white crystals. Slightly soluble in cold water, and 3.3 at 100°C. Slightly soluble in dilute hydrochloric acid. Insoluble in alcohol. Grades: Technical, Purified powder, C. P. powder. Containers: Cartons (1 lb.); Bottles (1, 5 lb.); Barrels.

Lead Chromate: $PbCrO_4$. Mol. wt. 323.22. Sp. gr. 6.12. M. P. 844°C. Yellow crystals, fused lumps or precipitated powder. Also known as Chrome Yellow. Decomposes when heated over 844°C. Insoluble in water, acetic acid. Soluble in acids and alkalis. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Cans (25 lb.); Barrels.

Lead Dioxide: See Lead Oxide, Brown.

Lead Dithionate: $PbS_2O_6\cdot 4H_2O$. Mol. wt. 439.39. Sp. gr. 3.22. Trigonal crystals. Decomposes when heated. Soluble in water.

Lead Flake: See Lead Carbonate, Basic.

Lead Fluoborate: $Pb(BF_4)_2$. Mol. wt. 380.85. Sold as a water solution.

Lead Fluosi'icate: $PbSiF_6\cdot 2H_2O$. Mol. wt. 385.30. Monoclinic, colorless crystals. Also known as Lead Silicofluoride. Soluble in cold water. Very soluble in hot water. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Solution—Carboys.

Lead Iodide: PbI_2. Mol. wt. 461.05. Sp. gr. 6.16. M. P. 400°C. B. P. 954°C. Hexagonal yellow crystals or powder. Very slightly soluble in water. Soluble in alkalis and potassium iodide solutions. Grades: Technical, N. F., C. P. Containers: Bottles (1, 5 lb.); Boxes.

Lead Monoxide: See Lead Oxide, Yellow.

Lead Nitrate: $Pb(NO_3)_2$. Mol. wt. 331.23. Sp. gr. 4.53. Colorless, monoclinic or cubical crystals. Solution, 25°Bé. Solubility, 38 at 0°C. and 126 at 100°C. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5 lb.); Boxes (5, 25, 50 lb.); Barrels 400, 500, 600 lb.); Casks (950 lb.). Liquid—Drums (100 lb.); Kegs, Carboys (100, 125 lb.); Barrels (500 lb.).

Lead Oxide, Brown: PbO_2. Mol. wt. 239.21. Sp. gr. 9.38. Tetragonal brown crystals. Also known as Lead Dioxide, Lead Peroxide, Lead Superoxide. Decomposes when heated. Insoluble in water. Soluble in dilute hydrochloric acid. Slightly soluble in acetic acid. Grades: Technical, C. P. Containers: Cartons (1 lb.); Bottles; Cans (1, 5 lb.); Steel Drums.

Lead Oxide, Red: Pb_3O_4. Mol. wt. 685.63. Sp. gr. 9.1. Crystalline red scales or red amorphous powder. Also known as Red Lead, Minium, Plumboplumbic Oxide. Decomposes when heated. Insoluble in water. Soluble in hot hydrochloric acid and in acetic acid. Grades: Technical, N. F., U. S. P., C. P. Containers: Bottles, Cartons (1, 5 lb.); Kegs (12½, 25, 50, 100, 150 lb.); Bags, Drums (100 lb.); Barrels (500 lb.).

Lead Oxide, Yellow: PbO. Mol. wt. 223.21. Sp. gr. 9.30. M. P. 888°C. Tetragonal yellow crystals or yellow powder. Also known as Litharge, Lead Protoxide, Lead Monoxide, Plumbago. Insoluble in water. Soluble in nitric acid, alkalis, chloride solutions, lead acetate solutions. Grades: Technical, N. F., C. P., Assayers (silver free). Containers: Bottles, Cartons (1, 5 lb.); Barrels (12½, 25, 50, 100, 500, 600 lb.); Kegs (25, 200 lb.); Drums (100 lb.).

Lead Perch'orate: $Pb(ClO_4)_2\cdot 3H_2O$. Mol. wt. 460.17. Sp. gr. 2.6. Rhombic white crystals. Decomposes when heated and in hot water. Very soluble in cold water. Grades: Technical, Purified. Containers: Bottles (1 oz., 1 lb.).

Lead Peroxide: See Lead Oxide, Brown.

(To be continued next month)

Abbreviations: Mol. wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than Technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary.

SHOP PROBLEMS

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Testing and Stripping Reference

Question: We should like to receive the articles by Dr. Egeberg on the testing and stripping of electrodeposits. Will you be kind enough to send them to us?—I. S. & Co.

Answer: We have received your letter which was addressed to Metal Cleaning & Finishing Co., at this address, in connection with the articles by Dr. Egeberg on the testing and stripping of electrodeposits.

The articles you referred to were written by Egeberg and Promisel and were published in *Metal Cleaning and Finishing* magazine. This magazine went out of existence either late in 1938 or 1939. You might communicate with Dr. Egeberg at the International Silver Co., Meriden, Conn. for copies or else have the New York Public Library make photostats for you.

Electrorefining of Tin

Question: Please forward articles from *Metal Finishing* regarding the electrorefining of tin.—H. Y.

Answer: We have not published any articles on this subject recently. However, the Tin Research Institute, Fraser Road, Greenford, Middlesex, England, should be able to help you and we suggest that you contact them for further details.

The books *Tin* and *Industrial Electrochemistry* by C. L. Mantell, contain some information which might prove interesting to you.

Further data are to be found in the patent abstracts given in *Metal Finishing*. If you do not have back issues on file, perhaps your local library can help you.

Formula to Matte Steel

Question: We should appreciate receiving a formula to matte steel, if there is one similar to that used to matte brass.—A. P. Co.

Answer: A suggested formula follows:

40-42° Baume ferric chloride solution	1 gal.
Hydrochloric acid	1 gal.

Operate at room temperature for 1-5 minutes.

This solution will produce a fine to coarse matte depending upon the time of immersion.

Preparation of Cd Plated Parts Prior to Organic Finishing

Question: I would appreciate receiving information as to whether there is a special method for lacquering or painting over a cadmium plate.—T. F.

Answer: Army-Navy Aeronautical Specification AN-QQ-P-421a specifies a dip in a weak chromic acid solution (approximately 3-5 per cent) for cadmium plated articles which are to be painted.

For optimum adherence we suggest that you communicate with your paint or lacquer supplier who can furnish you with materials specifically formulated for adhesion to cadmium.

Testing Specifications

Question: We are endeavoring to use the best possible means to control the quality of enameled and plated finished steel and other metal parts and would be interested in receiving from you any reprints from past issues of *Metal Finishing* showing procedures and equipment either available or used for such purposes. In addition, the names of any laboratory control equipment or any other information which it is believed may be of interest or assistance to us will be very much appreciated.—T. P. Corp.

Answer: This is a very extensive subject and we could not possibly give you complete details in a letter. We suggest, however, that you communicate with manufacturers of testing equipment who advertise in *Metal Finishing* and in the 1943 edition of the *Buyers' Directory*. You may be interested in the article entitled "Plating to Specification" by Nathaniel Hall which appeared in the July, 1938, issue of *Metal Finishing*.

Hard Chromium Plating Details

Question: I should like some information on hard chromium plating of cutting tools such as reamers used in making bullet dies. Will you please send me the details of this process?—A. N.

Answer: There is a very complete section on hard chromium plating on pages 50-54 of the 1942 *Plating and Finishing Guidebook*. If you are a subscriber to *Metal Finishing*, you should have received a copy of this guidebook and if not, you may secure one at a cost of fifty cents.

Removal of Film from Electrodeposited Silver

Question: Please advise if you know of any bright dip which will immediately remove the cloudy white effect secured after silver plating brass dials.—C. A. T.

Answer: We know of no bright dip which will remove the cloudy film from electrodeposited silver.

If the silver is applied by immersion without current in a solution of 1 oz./gal. silver cyanide and 1 oz./gal. sodium cyanide, the deposit will be bright but thin.

Electropolishing Reference

Question: Some time ago an article on electrochemical polishing appeared in *Metal Finishing*. After quite a search we are unable to find the desired piece and would appreciate it if you would direct us to it.—H. C. E. Co.

Answer: The article you are interested in is probably the one by C. B. F. Young and W. L. Brytczuk which was published in the June, 1942 issue beginning on page 306. This article lists a large number of electropolishing solutions and the results of tests made with them.

Finish for Low-Priced Food Items

Question: For many years we made and sold a special type of low-priced corn holder. They were barrel plated in nickel. Unexpectedly, 650 pounds of them turned up in a re-check of inventory and we now find ourselves unable to finish them properly for disposal to the trade. We tried to get a priority but failed. It was suggested that we plate them with silver.

The difficulty is that this is a very low-priced number, selling for less than ten dollars per gross pair. If they were plated in still tanks, the cost would be prohibitive. The question is, have you a list of concerns who have silver barrel plating who are in a position to handle this item?

The procedure is to give them a thorough burnishing after which they are barrel plated and finally finished.—U. S. Co.

Answer: There is no cheap finish available today without government restrictions except lead but this would be entirely unsuitable for food purposes.

You might receive permission from the War Production Board to use silver in sufficient quantities to refinish the 650 pounds of work you have left in order that they might not be a total loss. In such case, you would probably find that a local plater would be prepared to plate them for you.

A possible finish which might be suitable for these articles is a good lacquer. However, most of these are sold on a priority basis also.

Patents

Cleaning & Pickling Strip

U. S. Pat. 2,320,499. F. J. Wood, assignor to Goodman Mfg. Co., June 1, 1943. In a continuous pickling and cleaning apparatus for strip metal, a pickling trough through which the strip metal is adapted to pass during the pickling operation, a plurality of laterally and longitudinally spaced blocks along the bottom of said pickling trough and forming a means for supporting the metal above the bottom of said trough as it passes therethrough, transversely extending shafts spaced along said pickling trough forming a mounting for said blocks in said pickling trough, and means adjustably mounted on the bottom of said pickling trough for guiding a plurality of strips of metal therethrough in side by side relationship including a plurality of centering guide members detachably mounted on said shafts in laterally spaced relationship to each other.

Refacing Abrasive Belts

U. S. Pat. 2,320,569. H. Conrady (Germany), vested in the Alien Property Custodian, June 1, 1943. In the method of renewing the usefulness of worn abrasive belts in which the abrasive has been bonded to the backing member by glue or other similar material, the steps comprising placing said belt upon pulleys in a closable heated chamber, subjecting said belt to a preliminary dry cleaning by a rotary brush and then to the action of moist heat to melt the glue bond causing the belt to move about said pulleys, subjecting the grit bearing face of said belt to the action of a second rotary brush while the belt is moving about said pulleys and while said bond is in a softened condition to relocate the worn abrasive on said belt thereby exposing new sharp cutting faces on the abrasive grains and subsequently cooling and drying said belt to recement the relocated abrasive grains thereon.

Thickness Measurement

U. S. Pat. 2,320,761. W. H. Tait & B. Chalmers (England), June 1, 1943. Apparatus for determining the thickness of a relatively thin layer carried by a magnetizable base member comprising, a transformer including a primary winding and a secondary winding and a magnetizable core adapted to be bridged at ends thereof by said base member forming a magnetic circuit with said layer forming a gap in the magnetic circuit, means for supplying alternating current to said primary winding, means for measuring the voltage across the secondary winding, and means for magnetically saturating said core.

Anode

U. S. Pat. 2,320,773. C. G. Fink & M. Kolodney, assignors to Electro Manganese Corp., June 1, 1943. A composite anode for use in the electrodeposition including the electrowinning of manganese comprising an electrically conducting core and an outer layer containing about 9% to about 50% tin, a small amount to about 4.4% cobalt effective to minimize manganese dioxide formation and the balance principally lead. A process for the electrodeposition of manganese including the electrowinning of manganese, which comprises electrolyzing a solution containing manganese sulfate, ammonium sulfate and sulfuric acid in the presence of an anode comprising an electrically conducting core and an outer layer containing about 9% to about 50% tin, a small amount to about 4.4% cobalt effective to minimize manganese dioxide formation and the balance principally lead.

Coating Aluminum for Rubber Adhesion

U. S. Pat. 2,320,998. M. C. Beebe, assignor to Scovill Mfg. Co., June 8, 1943. The method of coating an aluminous metal surface which comprises depositing a black nickel coating thereon by subjecting said surface to the action of a black nickel coating bath containing a dissolved nickel salt, a dissolved sulfur compound and a minor amount of a dissolved copper salt, and thereafter vulcanizing rubber onto the said black nickel coating.

Example:

Nickel sulfate	6 oz./gal.
Zinc sulfate	1 "
Sodium thiocyanate	1.5 "
Current density	1-2 amp./sq. ft.

Ammonia or ammonium sulfate may be added.

Example:

Immersion bath for aluminum alloys containing copper.

Water	1,000 cc.
Ammonia	50 "
Sodium citrate	50 g.
Nickel acetate	25 "
Sodium thiosulfate	37.5 "
Potassium thiocyanate	25 "

Immerse about one min. at about 130°F.

Example:

Immersion bath for copper-free aluminum alloys.

Water	1,000 cc.
Ammonia	62.5 "
Sodium citrate	25 g.
Nickel acetate	25 "
Sodium thiosulfate	25 "
Potassium thiocyanate	25 "
Copper acetate	2.5 "

Immerse for a few seconds at 90°F. or over.

Coating Aluminum for Rubber Adhesion

U. S. Pat. 2,320,999. M. C. Beebe, assignor to Scovill Mfg. Co., June 8, 1943. In methods of bonding, to the surface of aluminum articles, a plastic selected from the class consisting of rubber, vulcanized rubber, chlorinated rubber, rubber hydrochloride, polymerized chlorobutadienes and butadiene copolymers, the improvement which comprises subjecting the surface of an aluminum article to the action of an aqueous alkaline solution containing in colloidal suspension a substance consisting of alumina, titania, zirconia and beryllia, and also containing a second dissolved metal compound selected from the class consisting of compounds of copper and compounds of the iron group of metals, said solution likewise containing a substance capable of forming an ion-containing complex, selected from the class consisting of soluble thiophosphates, phosphates and citrates, glue and gum arabic, the action being continued until there is produced on the article a coherent filmiform coating comprising a hydrated amphoteric oxide carrying an oxide of said second metal; drying the film and cohesively bonding a layer of said plastic to the film coating.

Example:

	1	2
Water	90	100 L.
Ammonia	10	10 "
Cupric hydroxide	300	300 g.
Sodium thiosulfate	2,000	2,000 "
Ammonium carbonate	500	...
85% Phosphoric acid	50	...
Iron phosphate	...	100 g.

Temperature: 160°-180°F.
Time: Few minutes to one-half hour.

Bright Nickel Bath

U. S. Pat. 2,321,182. H. Brown, assignor to The Udylite Corp., June 8, 1943. A method for electrodepositing nickel to obtain a fine-grained deposit comprising the step of electrodepositing nickel from an aqueous acid nickel solution comprising essentially a material selected from the group consisting of nickel sulfate, nickel chloride, and a mixture of nickel chloride and nickel sulfate in the presence of an aliphatic polyhalogenated aldehyde soluble in the solution and having at least one halogen atom in alpha position to the aldehyde group, the halogen substituents of the polyhalogenated aldehyde being selected from the chlorine and bromine group.

Example:

Nickel as sulfate	60-75 g./L.
Chloride as nickel chloride	15 "
Boric acid	30-37.5 "
Chloral hydrate	0.5-1.5 "

pH = 2.6, Temp. = 50°C., C.D. = 1-5 amp./sq. dm.

Electrical Conducting Films

U. S. Pat. 2,321,587. P. Davie & A. L. Halvorsen, said Halvorsen assignor to said Davie, June 15, 1943. The method of forming an electrically conductive coating on a base which comprises applying to the base a coating composition comprising finely-divided particles of an electrically conductive material and a bonding medium, the applied coating being of relatively high electrical resistance, impressing a voltage between two conductors, placing said conductors in close proximity to separated areas of said applied coating to cause current to flow and thereby substantially reduce the electrical resistance of the coating between said separated areas, and passing at least one of said conductors over the surface of the applied coating to reduce the electrical resistance of substantially the whole of said surface.

Vitreous Enamel

U. S. Pat. 2,321,656. A. E. Chester, assignor to Poor & Co., June 15, 1943.

A coating composition, for use in enamel coating processes, consisting of a mill formula including an aqueous alcohol vehicle, a bonding compound formula composed of antimony trioxide, titanium hydroxide and nickel chloride, and a blend of a raw glass batch of relatively high maturing temperature with an eutectic frit of a relatively low maturing temperature.

Vitreous Enamel

U. S. Pat. 2,321,657. A. E. Chester, assignor to Poor & Co., June 15, 1943. A coating composition for use in enamel coating processes, consisting of a mill formula including an aqueous alcohol vehicle, a bonding compound having a base of antimony trioxide and titanium hydroxide and including sodium zirconium silicate, and a blend of a raw glass batch of relatively high maturing temperature with an eutectic frit of a relatively low maturing temperature.

Vitreous Enamel

U. S. Pat. 2,321,658. A. E. Chester, assignor to Poor & Co., June 15, 1943. A process of preparing a bonding compound for use in enamel-coating processes, which consists in first preparing a basic mixture composed of antimony oxychloride, silica gel, and an alkaline arsenate salt, then dry mixing said basic mixture and subsequently combining the same in an aqueous colloid with stannous chloride and bentonite to complete the composition, and finally grinding the said complete composition to a fineness for use as a spray.

Vitreous Enamel

U. S. Pat. 2,321,763. G. H. McIntyre & E. E. Bryant, assignors to Ferro Enamel Corp., June 15, 1943. In the art of porcelain enameling, the process of providing a coat of porcelain enamel applied directly to a ferrous surface, which comprises providing a plurality of porcelain enamel frits of compositions suitable for direct application to the work and differing in the limits of their respective fusion ranges by temperatures of from 25° F. to 100° F., preparing a slip comprising a mixture of from about 1 to 4 to about 4 to 1 parts of said different frits, the frit of the relatively high fusing range reduced to a fineness such that from about 85% to about 95% will pass through a 325 mesh screen and the frit of the relatively lower fusion range reduced to a fineness such that from about 85% to about 98% will pass through a 200 mesh screen, and from about 5% to about 50%, based on the total amount of frit, of a material selected from the class consisting of silica, quartz and feldspar and of a particle size substantially larger than colloidal but generally smaller than that of the frit, applying such slip to the work and firing the same at a temperature between the limits of the fusion ranges of the frits.

Corrosion Prevention of Magnesium

U. S. Pat. 2,321,948. R. Shawcross, assignor to Aluminum Co. of America, June 15, 1943. A method for producing a protective coating on the surface of an article of magnesium which comprises treating said surface with an aqueous solution containing between about 1 and about 10 per cent of at least one alkali metal chromate and between about 10 and about 60 per cent of basic aluminum nitrate, said basic aluminum nitrate containing excess alumina in an amount between 1 and about 60 per cent forming a complex with said aluminum nitrate.

Example:

Basic aluminum nitrate	24.1%
(Excess alumina content)	11.2 "
Potassium dichromate	5.0 "
Wetting agent	0.2 "

Temp. = 95-100°C. Time = 15-60 minutes.

Articles may be anodized in this solution for 10-30 minutes at 0.25-2.0 amp./sq. in.

Pickling Waste Recovery

U. S. Pat. 2,322,134. W. W. Hodge, assignor to Mellon Institute of Industrial Research, June 15, 1943. The method of reclaiming spent pickling solution containing ferrous sulfate which comprises effecting precipitation of ferrous sulfate from cold spent pickling solution by the addition of a water-soluble ketone, and separating the precipitate.

Corrosion Prevention of Metals

U. S. Pat. 2,322,349. G. W. Jernstedt, assignor to Westinghouse Electric & Mfg. Co., June 22, 1943. An aqueous solution for activating ferrous and zinc metal surfaces to accelerate the formation of corrosion resisting coatings thereon comprising sodium pyrophosphate and at least one titanium compound.

Example:

A soluble titanium salt is added to a water solution of ortho-disodium phosphate and the mixture evaporated to dryness at temperatures above 60°C. The dried compound may contain from 0.005-up to 20% by weight of titanium radical. This dried compound is dissolved in water to produce a solution having from 0.1 to 2% of disodium phosphate and generally from 0.005 to 0.05% of titanium ions in solution. A 1% solution of disodium phosphate with 0.01% titanium radical seems to be best. The pH at this concentration is from 8.0 to 8.5.

The activating solution is applied for 45 seconds or longer, after which the object is treated with the usual phosphate coating solutions.

Polishing Machine

U. S. Pat. 2,322,589. T. F. Philippi, June 22, 1943. A polishing machine comprising a work support, polishing means located above said support for vertical movement relative thereto, and means for substantially counterbalancing the weight of said polishing means, said counterbalancing means comprising a lever disposed below the level of said polishing means and pivotally supported intermediate between its ends for vertical swinging movement, an extensible longitudinally cushioned prop pivotally supported on one arm of said lever and extending upwardly therefrom into engagement with said polishing means to provide a removable support therefor, and counterbalancing weights mounted on the other arm of said lever.

Washing Machine

U. S. Pat. 2,323,154. N. Ransohoff, June 29, 1943. A washing apparatus, which comprises a wash drum of a relatively large diameter, a rinse drum of a relatively smaller diameter extending longitudinally from the wash drum and being substantially coaxial therewith, an annular wall member joining the rinse drum and the wash drum, a vane extending spirally from the annular wall into the wash drum, the said vane terminating in a portion of reduced height whereby it is adapted to act as an agitator of parts deposited in the washing drum and as a conveyor for urging parts toward the rinse drum, and a dam and lift member residing intermediate the vane and the annular wall and extending substantially tangentially from the periphery of the rinse drum to the periphery of the wash drum.

Stripping Films

U. S. Pat. 2,323,424. G. Schore, July 6, 1943. In printing forms of the class wherein a metallic shell is electroplated on a metal base of the group consisting of copper and nickel, the combination of a metal base of said group and an adherent film thereon produced by the action upon the base of an acidic aqueous solution consisting essentially of the ions Cl^-, SO_4^{--}, NO_3^-, and Cu^{++}.

Example 1:

Hydrochloric acid	10 oz.
Copper nitrate	½ "
Copper sulfate	½ "
Ammonium sulfate	¾ "
Sodium chloride	1 "
Water	1 gal.
Methyl orange or selenium dioxide	1/16 oz.

Example 2:

Cadmium sulfide	½ oz.
Sulfuric acid	10 "
Copper sulfate	3 "
Ammonium sulfate	1 "
Water	1 gal.
Potassium permanganate or selenious acid	1/16 oz.

Example 3:

Copper sulfate	1.5 oz.
Nitric acid	6 "
Hydrochloric acid	3 "
Bismuth sulfate	¼ "
Water	1 gal.
Barium sulfide or selenium oxychloride	1/16 oz.

Example 4:

Nickel nitrate	2 oz.
Copper nitrate	6 "
Nitric acid	3 "
Water	1 gal.
Black antimony sulfide or tellurium dioxide	1/16 oz.

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

New Electrolytic Process for Zinc Protection

By treating zinc anodically in baths made up of Anozinc salts, not only is the rust resistance of zinc coated steel parts materially increased, but the formation of white zinc corrosion products is retarded, according to United Chromium, Inc., Dept. MF, 51 East 42nd St., New York 17, N. Y., manufacturer of the product.

Parts finished in Anozinc and subjected to standard salt spray tests (AN-QQ-S-91) to determine the rustproofing qualities of the finish have stood up in excess of 200 hours, it is claimed. As a result, zinc plate followed by Anozinc may often be substituted for more strategic metals where high salt spray resistance is required.

There are two baths available, one giving a black and the other a yellow finish. The anodizing treatment is applied preferably over a zinc deposit of approximately 0.0002" in thickness and produces no appreciable dimensional change.

In most cases existing plating facilities can be readily converted for use with this process. A conventional cleaning cycle is recommended preparatory to the treatment, which is carried out at room temperature in an unlined steel tank. Steel cathodes are used, and the work is made anodic at six volts or less. At a current density of 20 amp./sq. ft., about three minutes are required to produce the finish. After rinsing, the parts are ready for handling as the finish does not require ageing or force drying subsequent to treatment.

The constituents of the baths are stable and easy to control, it is said, and throwing power is good; in general, the only features to check and maintain are specific gravity and pH.

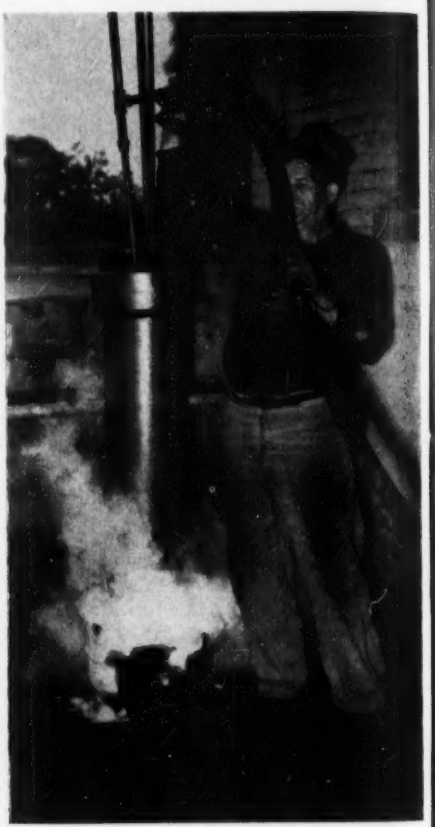
New Chemical Stoneware Said to Resist Thermal Shocks

It is claimed that the new chemical stoneware announced by the U. S. Stoneware Co., Dept. MF, Akron, O., will withstand violent thermal shocks.

Known as "Ceratherm 500," it is said to be the first low-porosity chemical stoneware in the history of ceramics that can be heated by direct steam or hot gases, and that can be cooled quickly.

Chemical stoneware has long been the only material of construction which is completely inert to the attack of all acids, alkalis, and solvents (with the exception of hydrofluoric acid and hot caustics). Coupled with its resistance to chemical attack has been the ease with which it could be fabricated into equipment of large size and unusual shape. These, plus its low cost and ready availability, have given it high ranking in the chemical field.

Unfortunately, chemical stoneware, besides being somewhat fragile, was never able to withstand any degree of thermal stress. Heating had to be done slowly and carefully, either by the use of hot oil or sand baths, or by jacketing. Heating by direct steam or hot gases was impossible. Cooling was equally precarious. Repeated heating and cooling, no matter how carefully done, progressively weakened the body until structural failure occurred, usually without warning.



"Ceratherm 500" — unaffected after being packed in dry ice and blasted with superheated steam.

The manufacturers claim that "Ceratherm 500" actually increases in strength, however, when heated to 400° F. and quenched, and that it shows no loss of strength after repeated heating to this temperature and cooling.

The new body is a result of the discovery by the company's ceramists of a method, on which patent applications are pending, of eliminating a large part of the glassy bond of high silica and alkali content common to clay bodies.

The new stoneware is now in large scale production on such items as tanks, crocks, boiling kettles, mixing kettles, cooling and condensing coils, evaporating dishes, pumps, sinks, pipe, etc. The materials used are all non-critical, and priorities are not necessarily a prerequisite to obtain it.

Professional Directory

CONSULT US ON
GOVERNMENT & INDUSTRIAL SPECIFICATION PLATING
A. ROBINSON & SON
131 Canal St., New York
Telephone CAnal 6 { 0310 / 0464
64 Years in Precious Metals

Platers Technical Service Co.
Electroplating and Chemical Engineers
Complete services, including solution analyses, process development and deposit tests.
S. C. Taormina ..... Tech. Director
Dr. C. B. F. Young ..... Tech. Advisor
Dr. G. Amorosi .. .. Engr. Advisor
(Professional Engineer)
59 E. 4th St., N. Y. C. **ORchard 4-1778**

G. B. HOGABOOM JR. & CO.
Consulting Chemical Engineers
SALT SPRAY TESTING — CERTIFIED TO MEET ARMY AND NAVY SPECIFICATIONS. Testing of deposits-thickness, composition, porosity. Solution analyses, plant design, process development.
44 East Kinney St. Newark, N. J.

JOSEPH B. KUSHNER, Ch.E.
Metal Finishing Consultant
War plating plants designed and streamlined for increased production.
LA 4-9794 **233 W. 26th St.**
New York City

BECKMAN pH NOTES

BETTER PLATING THROUGH MODERN pH CONTROL

NO. 5 OF A SERIES

Showing how pH affects plating of brass, cadmium, zinc, copper and similar metals.

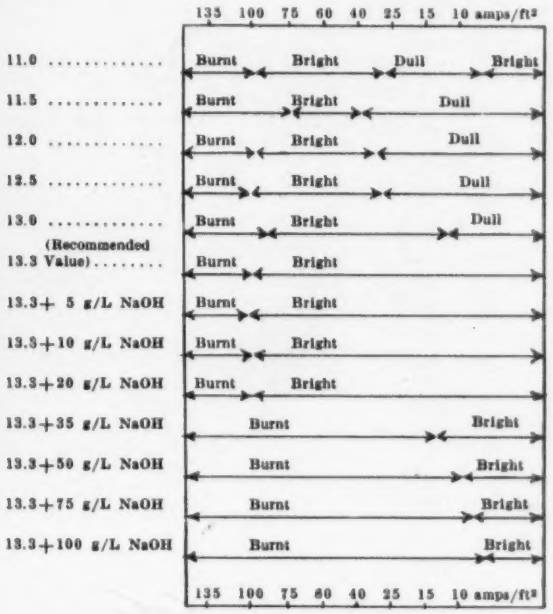
How to Get Clear, Uniformly Smooth Coatings on Cadmium Plating Work!

CADMIUM PLATING

1. "Cadalyte"

Composition	Oz./Gal.
Du Pont "Cadalyte" Salts	24.0

Temperature = 75°-80° F.
Hull Cell Plating Time = 3 min.
Hull Cell Current = 5 amps.


Bath pH
Hull Cell Plating Range
135 100 75 60 40 25 15 10 amps/ft²
11.0 ..... Burnt Bright Dull Bright
11.5 ..... Burnt Bright Dull
12.0 ..... Burnt Bright Dull
12.5 ..... Burnt Bright Dull
13.0 ..... Burnt Bright Dull
(Recommended 13.3 Value)..... Burnt Bright
13.3+ 5 g/L NaOH Burnt Bright
13.3+10 g/L NaOH Burnt Bright
13.3+20 g/L NaOH Burnt Bright
13.3+35 g/L NaOH Burnt Bright
13.3+50 g/L NaOH Burnt Bright
13.3+75 g/L NaOH Burnt Bright
13.3+100 g/L NaOH Burnt Bright
135 100 75 60 40 25 15 10 amps/ft²

IN CADMIUM plating, the pH of the plating bath has an important influence upon the quality and uniformity of the coatings obtained. The accompanying chart* shows the interdependence of pH and current density in the production of bright clear cadmium platings. Note how, when the pH becomes too high, a dull burnt plate results over the major portion of the operating range. And as the pH becomes too low the operating range in which a bright plate is obtained becomes increasingly restricted.

Therefore, accurate pH control of the plating bath is essential for consistently uniform cadmium coatings . . . *and the only modern pH equipment with which such control can be maintained is with Beckman pH Equipment!*

Why? Because *only* Beckman provides High pH Glass Electrodes . . . electrodes that for the first time permit the accuracy and speed of modern glass electrode pH control to be applied to highly alkaline plating solutions, *even in the presence of sodium ions.*

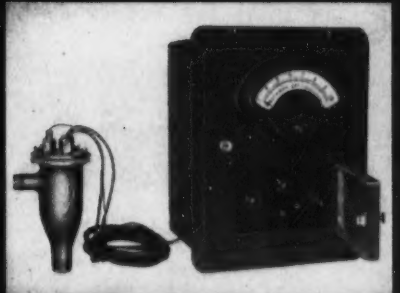
This Beckman development is of vital importance not only to cadmium plating, but to all brass, copper, zinc and similar cyanide plating operations!

Whether your plating operations are on a small or large scale, investigate the vital savings in time and material that you can make with Beckman pH Control. There's a Beckman pH instrument to fit *your* requirements. Write for detailed information! *Beckman Instruments, National Technical Laboratories, South Pasadena, California.*

* Gray-Proc. Amer. Electroplaters Soc.

SEND FOR THIS FREE BOOKLET

"What Every Executive Should Know About pH" . . . an interesting, informative booklet on the fundamentals of modern pH control. Ask also for Bulletin which lists and describes Beckman instruments, electrodes and accessories!



THE BECKMAN AUTOMATIC pH INDICATOR is the most advanced pH instrument available for large-scale plating operations. Automatically indicates, records, and controls. *Ask for Bulletin 16!*

THE BECKMAN INDUSTRIAL pH METER is ideal for portable plant and field use in the electro-plating plant. Highly accurate, simple to operate, ruggedly built. *Ask for Bulletin 21!*

New uses for zinc and cadmium plated articles made possible by . . .

IRIDITE

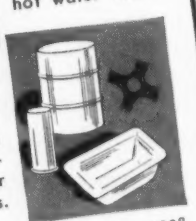
How to use IRIDITE

Plated parts are dipped into Iridite Solution from 10 to 60 seconds, and then are immediately rinsed in hot water.

As soon as the dipped part has been dried free of water, it can be handled without danger of injury, and shipped.

Only equipment needed is an acid-proof container for the Iridite Solution* and one for the hot water rinse.

The Iridite Process can be applied to plated parts of any type or size, excepting containers for edible products.



*Iridite Solution is used at from 75° to 100° depending on individual requirements.

• This new, super-thin, easy-to-apply, low-cost coating increases resistance to corrosion to a marked degree. It offers every parts manufacturer the opportunity of increasing the field of usefulness of zinc and cadmium as protective coatings. *Iridite* makes it possible to use these metals for plated parts, under conditions of exposure which would ordinarily never be considered.

Caused by a chemical reaction with the plated metal itself, *Iridite* is uniform, opaque and olive drab in color. The olive drab matching the familiar shade used by the armed forces for camouflage.

Although *Iridite* gives remarkable protection against corrosion from all ordinary means, it is so thin that it does not "pile up" to alter the dimensions of the part.

In addition, after it has been applied, the flexibility of *Iridite* permits parts to be bent, twisted, or formed, without chipping, flaking or affecting the protective qualities of the *Iridite* coating.

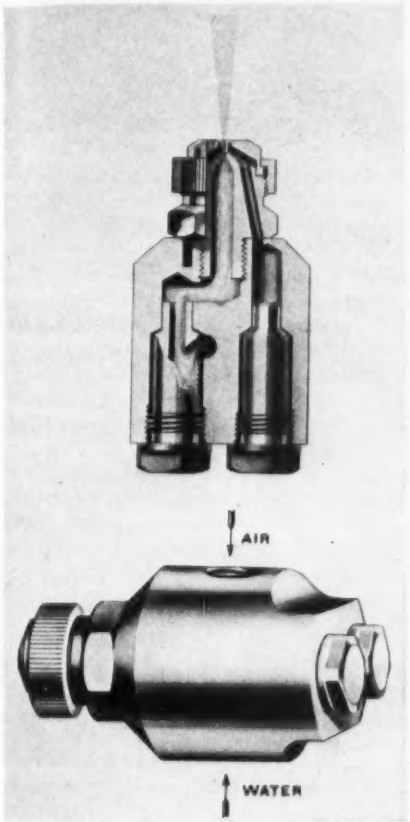
If you manufacture parts that are exposed to weather or to corrosion (except containers for food), you should send, immediately, for full details on the *Iridite* process. Better still, send us a plated part for *Iridite* coating, and test it any way you like.

Rheem Research Products
INCORPORATED

Subsidiary of Rheem Manufacturing Co.,
1209 East 25th Street, Baltimore, Md.

New Pneumatic Atomizing Nozzle for Humidification Systems

For use in the many modern processes requiring close control of atmospheric conditions, Spraying Systems Co., Dept. MF, Chicago, Ill., has developed an improved type of pneumatic atomizing nozzle. In this nozzle, Type JHS, water and compressed air are mixed externally to produce a round spray. This spray is projected from 10-20 feet depending on air pressure used in the humidifying system.



Because this new nozzle is a complete unit in itself, it can be adapted to almost all types of installations. Two Monel metal strainers—one for air, the other for water—are included right in the body of the nozzle. This permits easy removal of the strainers for cleaning or replacement without disturbing the nozzle or lines and eliminates clogging of the nozzle orifice by pipe scale or other dirt loosened by accidental jarring of lines.

All parts are accurately machined of brass and white coated, and every part is easily renewable.

New Addition Agent

The Electroplating Division of E. I. du Pont de Nemours & Co. has announced that less than one ounce of a new chemical per gallon of copper electroplating solution reduces by one-third the copper required for electrotype printing plates, and cuts in half the scrap resulting from manufacture of these plates.

The chemical so increases the hardness of the copper deposit that a much thinner layer will give equal service, it is claimed. It allows a pound of copper to cover one-third more square inches of surface. It is also said to assure a smooth finish and speed the plating of the electrotypes.

According to the company, the agent eliminates inferior plating on the edges and corners of the printing plates, thus permitting a reduction in the width of "safety bearers", and accounting for a reduction to half the copper scrap usually resulting from electrotype production.

This new chemical is especially timely for electrotypers. They formerly used about 2,200 tons of copper anodes annually, and their supplies have been drastically cut during the war.

Electrotype printing plates are made by electrodepositing a thin layer of copper on a specially prepared mold of wax or some other substance. When the mold is removed, the copper "shell" is backed up with tin and an alloy and mounted on a wooden block for attachment to the printing press.

Headband

A new resilient non-rubber elastic-action headband called "Holdtite" is claimed to be not only a Victory replacement but actually superior to rubber headbands, according to the manufacturer, Carter-Lockard Co., Dept. MF, 225 W. 11th St., Los Angeles, Calif.

As the "Holdtite" headband has the stretch of elastic, it is highly efficient for workers who wear goggles or respirators; in fact, wherever rubber-elastic headbands have been in use. The headband is easy to adjust for comfortable fit and the maker outlines that once set, the headband cannot loosen as there is no elastic to get old, weak and over-stretched.

PURICO PUR-BLAC

Black Finish for Steel & Iron
One bath, low temperature salts

Let our Technical Department Process Samples for you.

•

PURICO ZN BLACK

A hard adherent black for zinc and zinc die castings

PURICO A. P. I.

(Acid Pickling Inhibitor)

PURICO PUR-BUR

A new compound for the deburring of aluminum

•

THE PURITAN MFG. CO.
WATERBURY, CONNECTICUT

DISTRIBUTORS:

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SESSIONS-GIFFORD CO. Providence, R. I.
W. D. FORBES Minneapolis, Minn.

How to make
POLISHING WHEELS
Last Longer!

- If possible have one or two experienced men set up all polishing wheels.
- Maintain an even temperature of about 80 degrees in set-up room to keep the best adhesive qualities in glue or cement.
- If using glue, use a high quality glue, preferably a "first-run" hide glue. Prepare glue carefully according to directions issued by your grain supplier.
- Clean the face of the polishing wheel with an abrasive brick. (New wheels should be trued up in a lathe to raise a nap.)
- Pre-heat wheel and abrasive grain at about 125 degrees F. Never boil glue. Apply it at a temperature of about 135 degrees F.
- Apply abrasive to prepared wheel either mechanically or by hand but in any case see that the wheel is rolled firmly and uniformly in the abrasive.
- The temperature in the dry room should be about 85 degrees and humidity at about 50 percent.
- In use, maintain proper wheel speed—7500 surface feet per minute for glue wheels and up to 9000 surface feet per minute for wheels set-up with cement.

Uniformity of the abrasive grain used in polishing wheels is most important, so insist on LIONITE Abrasive Grains. Rigid controls and Laboratory tests throughout the entire process of manufacture insure maximum uniformity from lot to lot. LIONITE comes in grades and sizes to fit every polishing requirement.

GENERAL ABRASIVE CO., INC.

NIAGARA FALLS, NEW YORK, U. S. A.

New Process Bonds Plating Metals to Plastics, Glass, Etc.

A new process by which plastic, glass or any non-conductor is plated with any plating metal is announced by Precision Paper Tube Co., Dept. MF, Special Products Division, 2023 West Charleston St., Chicago 47, Ill.

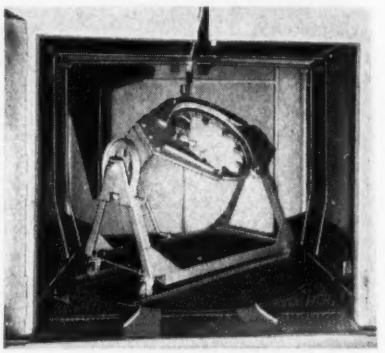
By this new process convex and concave surfaces, convolutions, corners, recesses, etc., are said to be as thoroughly plated as are flat and simple round surfaces. The plating is reported to be permanent and not to crack, chip or peel off during long or severe service.

The process can be used to plate magnetic and electric shielding of all kinds, radio shielding, electrostatic and magnetic shielding, applications as coil shields, condensers, etc.

Machine Cleans Entire Aircraft Engine in One Operation as It Comes Off Assembly Line

Development of a cabinet-type cleaning machine to simplify and speed the movement of aircraft engines on the production line, has been announced by the Howard Engineering and Mfg. Co., Dept. MF, 1032 Hulbert St., Cincinnati, O. This machine, the manufacturer states, is designed to conserve vitally needed man-power by reducing manual operations to a minimum.

Continuous cleaning is obtained by the use of a turntable designed to hold the engine and its assembly stand as it comes off the production line. This turntable revolves at 4-6 r.p.m. to produce complete

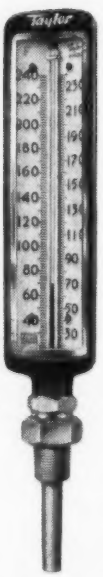


wash, rinse and drying operations on one engine in about 20 minutes.

Wash and rinse solutions are both applied through one set of spray pipes which extend completely around the engine and its stand. First wash water, then rinse water, is pumped on the engine parts, after which heated, high-velocity air is ejected through the blow-off nozzle, to effectively dry excess water from the engine surfaces.

The machine illustrated is 13 ft. high, and is sunk 4 ft. below floor level to conserve space and to facilitate loading. The engine and its stand can be loaded directly into the machine without any lifting. This machine can be designed to accommodate any size engine and stand. It is also well suited to airfield use—on teardowns and assembly of engines, and to wash smaller, separate parts in baskets placed on the turntable.

Industrial Thermometer



Taylor Instrument Companies, Dept. MF, Rochester, N. Y., have designed, tested in the field, and are now introducing a one-piece industrial thermometer.

The one-piece case is shallower making it possible to see the mercury column through a wider angle of vision. The chromium-plated bezel fits snugly into the grooved case in such a way as to hold the thick glass front securely against four wavy tension springs. These springs are fastened under the scale. This construction is said to result in a dustproof, rattleproof, and practically fumeproof thermometer which can withstand vibration and severe shocks.

It is announced further that the new instruments are equipped with easy-reading Binoc tubing. They are furnished in many combinations of straight and angle stems, with threaded or union connections, and in many standard temperature ranges, within the limits of —40°F. to +750°F. Standard scale lengths are 7" and 9".

Manufacturers' Literature

Roto-Finish

Munning & Munning, Inc., Dept. MF, 202-208 Emmett St., Newark, N. J., has just released an illustrated folder on "Roto-Finish".

Both wet and dry process machines are illustrated and described and the "Roto Junior"—a unit especially designed to handle smaller parts and suitable for both wet and dry processes—is described.

New Plating Equipment Catalog

Frederic B. Stevens, Inc., Dept. MF, Larned and Third St., Detroit, Mich., has published a new catalog illustrating and describing its Full Automatic and Semi-Automatic Plating Equipment.

The catalog is profusely illustrated with reproductions of various model machines which point out their simplicity of construction, accessibility, absence of overhead construction, and other important details.

Several illustrations are of actual installations, showing bright nickel plating, bright dipping of brass parts in bulk, anodizing of aluminum pistons, cleaning and pickling prior to vitreous enameling and numerous other processing operations.

The text matter is clear and concise, having been prepared with marked absence of technical terms, so that the layman can readily see and understand the features of the company's line.

Anodic Degreasing of Steel and Copper

Are chemically clean surfaces essential? Plating authorities and shop practice have conclusively proven that successful plating and finishing operations must be preceded by thorough degreasing of the basis metal. Of timely interest to war production metal-working plants in this connection is a new, 16-page booklet, issued by *Oakite Products, Inc.*, Dept. MF, 18 Thames St, New York 6, N. Y., describing the use of a newly developed material, Oakite Composition No. 90, for the anodic degreasing of steel and copper.

The booklet explains how this material removes such tenacious foreign matter as insoluble smut, buffing, polishing, stamping, cutting, drawing compounds; grease, shop dirt, oil and other accumulations from steel and copper surfaces. It is also reported that Oakite Composition No. 90 provides a shallow, dense foam blanket on the surface of the solution which stays within definite limits and eliminates dangers of overflowing, fuming and explosion. Another problem solved by this material, the booklet states, is the removal of soil from parts having deep recesses which may not be exposed to good electrocleaning action due to their unusual shape or size.

Included in this manual are informative case histories describing the use of Oakite Composition No. 90 in cleaning aircraft, bomb and radio parts; steel shell magazines; cartridge boxes and many other types of war materiel prior to plating or other finishing operations.

DOING A GREAT JOB

No. 608 excels in the three wanted qualities: (1) adhesion to metal, (2) great chemical resistance, (3) fast drying.

Selective plating in alkaline solutions has always been a troublesome job. A Stop-Off that will hold-on-the-edge has been in demand in every shop where accurate results are necessary.

BUNATOL No. 608 is engineered to stand up in strong alkali plating solutions such as Copper, Zinc, Tin, Cadmium and Silver. (Also remarkable on those tough Hard Chrome jobs.)

BUNATOL No. 608 is proving a life-saver in many of America's well-known plating shops.

Splendid adhesion on any clean metal surface no matter how highly polished. Will not pit or etch any metal.

BUNATOL 608 STOP-OFF

Even in very thin films it has extraordinary chemical resistance to the destructive action of strong alkali.

All of these proven points make BUNATOL No. 608 the real Stop-Off for use in alkaline plating solutions.

Fast drying when applied by brushing, dipping or spraying. Stays where you put it and does not bridge or shrink.

If you are interested in testing this remarkable Stop-Off, your request for sample of BUNATOL 608 on your letterhead will bring it immediately.

NELSON J. QUINN COMPANY
TOLEDO 7, OHIO

MANUFACTURERS OF
PLATING AND ANODIZING RACK INSULATION
and STOP-OFF
EXCLUSIVELY

New "Wheelabrator" Operator's Manual

The illustrated manual on the care and operation of "Wheelabrator" airless abrasive blast cleaning equipment originally published in 1942 has been revised by *American Foundry Equipment Co.*, Dept. MF, 555 South Byrkit St., Mishawaka, Ind.

The instructions and suggestions contained in the manual are all based upon practical operating experience and will enable the operator to keep his equipment in the best possible condition.

Subjects covered in the booklet include: Care of the "Wheelabrator" Unit, General Maintenance Hints, Electrical Instructions, Ventilation Requirements, Proper Use of Abrasive, and Miscellaneous Suggestions.

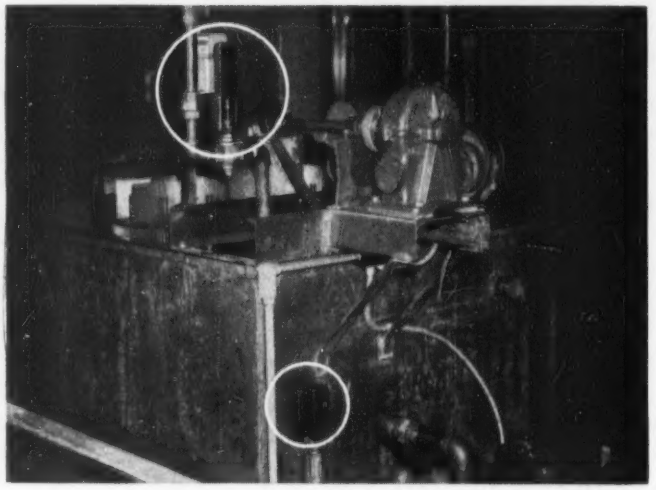
Industrial Polishing

With more and more inexperienced operators being put on polishing jobs every day, the new James H. Rhodes & Co. handbook and catalog will be of real service to manufacturers and plating shops. Among the features contained in it is a detailed outline of the proper way to set up polishing wheels. Another entire section is devoted to the care and maintenance of felt bobs and wheels with each step illustrated for easy reading.

The J. H. Rhodes Co., Dept. MF., 157 Hubbard St., Chicago, Ill., offers complete literature on all kinds of felt, rouges, steel wool—in fact, all related products used in metal finishing.

BARBER-COLMAN

AUTOMATIC TEMPERATURE CONTROL ON QUENCHING TANKS INCREASES SHOT PRODUCTION IN ORDNANCE PLANT



Better, faster production of one important item of ordnance has been made possible by the use of Barber-Colman electric MOTOR-OPERATED Valves for the maintenance of uniform temperature in quenching tanks. A typical installation is shown in the picture below. A Barber-Colman proportioning valve, capable of taking and holding any position between full open and completely closed, is installed on the cold water supply line. Its position is determined by a thermostat in the side of the tank. As the tank temperature tends to rise or fall, the flow of cold water is automatically adjusted exactly enough to provide a constantly uniform quench temperature. The result is increased production of exceptionally uniform quality. This system is adaptable to a number of other ordnance production requirements. Write for data.

BARBER-COLMAN COMPANY 1205 ROCK STREET ROCKFORD, ILLINOIS

COLOSSUS' INDUSTRIAL PRODUCTS

COLOSSUS BRAND* WHITE SPANISH

FELT WHEELS AND BOBS

Some part of every airplane, tank, ship, ordnance which come off the production line is polished with FELT WHEELS or BOBS. Polishing with such mediums is like polishing on a cushion . . . a factor that is necessary to the maintenance of precision specifications.

Colossus Brand Felt Wheels and Bobs are produced in Rhodes' mill at Jersey City under the supervision of men who have a thorough understanding of today's polishing and finishing needs. These Wheels and Bobs are made in a full range of diameters, thicknesses, densities to meet your specific requirements.

OTHER PROVEN COLOSSUS BRAND* PRODUCTS

Rhodes' industrial polishing, abrading and cleaning products include—Aluminide (Aluminum Oxide) . . . Dicarbo (Silicon Carbide) . . . Rouges . . . Powdered and Lump Pumice . . . Industrial Felts for all purposes . . . Steel Wool . . . Sponges . . . Chamois.

*COLOSSUS BRAND STANDS FOR FOUR DECADES OF MANUFACTURING, MINING AND MILLING EXPERIENCE

JAMES H. RHODES & COMPANY

137 W. HUBBARD ST. CHICAGO, 10, ILLINOIS

48-02 TWENTY-NINTH ST. LONG ISLAND CITY, 1, N. Y.

Write for this FREE FOLDER . . . Contact our home office for free technical advice on your industrial problems.

Rubber Gloves

A new catalog section on its line of anode process acid and industrial rubber gloves has been issued by *The B. F. Goodrich Co.* Dept. MF, Akron, O., and is now available upon request. The catalog section describes the process by which the gloves are constructed, the advantages which this imparts to gloves which must do heavy-duty service, and lists types and uses of the various gloves.

Time-Pattern Controller

The Brown Instrument Co., Dept. MF, Wayne & Roberts Ave., Philadelphia, Pa., has recently issued a new bulletin entitled "Brown New-Matic Time-Pattern Controller."

In some industrial processes it is not only essential that temperature, pressure, flow or liquid level be controlled at a constant point but experience has proven that it is desirable to gradually increase temperature, pressure, etc., to a certain high value, hold them at that value for a definite length of time and then decrease at a predetermined rate.

In such processes as these the company's time-pattern controller is said to provide the proper time scheduling to insure continuous maximum production of finished products of uniform quality.

Bulletin 87-1 describes in detail the operating principle of this two-unit time-pattern controller: (1) The pattern transmitter and (2) the control instrument. The text is supplemented with diagrams and illustrations of installations.

Associations and Societies

The Electrochemical Society

The following papers comprise the latest additions to the list of those scheduled for presentation at the New York meeting, October 13-16:

"Electrolytic Oxidation of Thiosulfate in Ethylene Glycol Solution" by *S. Glasstone, V. V. Barr* and *B. O. Heston;*

"Electro-Organic Chemistry in the Patent Office" by *Joseph Rossman;*

"Molecular Complexity of Some Gases in the High Frequency Discharge" by *H. O. McMahon* and *M. J. Marshall;*

"Electrical Characteristics of the Ozonator" by *T. C. Manley;*

"Acetylene Polymer Produced in Electrical Discharge" by *George Glockler;*

"Tin Plating from the Potassium Stannate Bath. Part II" by *F. A. Lowenheim;*

"Electrolytic Tin Plate from the Can Maker's Point of View" by *K. W. Brighton.*

"Electrodeposition of Cobalt-Tungsten Alloys from an Acid Plating Bath" by *M. L. Holt, R. E. Black* and *P. F. Hoglund;*

"Distribution of Galvanic Corrosion" by *H. R. Copson.*

NEW YORK MEETING PROGRAM

Wednesday, October 13

7:30 to 9:00 p.m.
Registration begins.

Thursday, October 14

8:00 a.m.
Registration.

9:00-10:30 a.m.
Board Meeting.

11:30-12:30
Session on "Electrolytic Cells and Corrosion."

12:30-1:30 p.m.
Luncheons of the Divisions.

2:00-4:00 p.m.
Session on "Electro-Organic Chemistry" (Gases).

4:00-5:00 p.m.
Richards Memorial Lecture: B. D. Saklatwalla.

7:00 p.m.
Reception. Informal dinner. Speaker and entertainment.

Friday, October 15

7:00-8:30 a.m.
Group breakfasts.

8:00 a.m.
Registration.

9:00-12:00 noon
Session on "Electro-Organic Chemistry" (Aqueous Electrolytes).

12:00-1:30 p.m.
General Luncheon. Luncheon speaker.

2:00-5:00 p.m.
Session on "Strip Steel and Wire Plating."

7:00-10:00 p.m.
Buffet supper and entertainment.

Saturday, October 16

7:00-8:30 a.m.
Group breakfasts.

8:00 a.m.
Registration.

9:00-12:00 noon
Session on "Strip Steel Plating."

12:00-1:30 p.m.
Informal luncheon.

2:00-5:00 p.m.
Round Table Discussion on "Induction Furnaces and Their Applications."

5:30 p.m.
Adjournment.

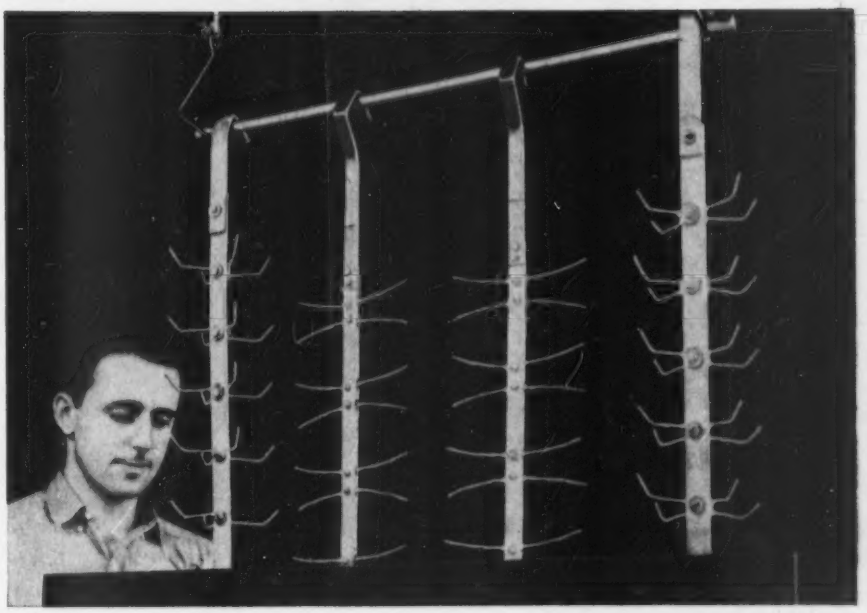
The American Electroplaters' Society

NEWARK BRANCH

Smith-Wagner Testimonial Dinner

The members of Newark Branch, A. E. S., are tendering a testimonial dinner to *Mr. Horace Smith* and *Mr. George Wagner* at the Hotel Robert Treat, Newark, on Saturday evening, October 23rd, at 7 p.m. Tickets are available at $4.00.

In the afternoon, the Newark Branch is holding an educational session at 3:30 p.m. at the Hotel Robert Treat. The subjects to be discussed are finishing of magnesium, silver plating on steel and lead plating.



The Application in Your Plant Of "MICCRO RACK COATINGS" is *Simple, Fast, Inexpensive*

In the usual cleaning and plating cycles no protective coatings are more effective than "Miccro" materials, yet their application requires only three simple operations. The rack is thoroughly cleaned before receiving the first coat . . . is dipped the recommended number of times . . . is hung up to air-dry after each dip. No tape or special treatment is needed. When especially fast drying is required, the materials may be force dried.

While it is possible to satisfactorily dip racks by hand, the use of some sort of mechanical dipping equipment is desirable. The only equipment necessary consists of a very simple dipping machine which usually can be built with parts and materials often on hand in the average plant. A blue print showing typical construction and parts necessary will be furnished free of charge upon request to this company.

Full information on the materials best suited to various applications will be supplied immediately upon request.

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DAYTON BRANCH

A Regional Meeting of the Indianapolis, Anderson, Cincinnati and Dayton Branches of the American Electroplaters' Society will be held at the Miami Hotel in Dayton, O., on Saturday evening, November 6, 1943.

The general technical meeting will follow a dinner at which the principal speaker will be *Dr. Gustav Egloff*, president of the American Institute of Chemists and director of research of Universal Oil Products Company, Chicago.

The author of nearly 500 technical articles and the holder of several hundred patents, Dr. Egloff is considered an outstanding authority in the cracking of petroleum for the production of gasoline and other petroleum products. His address will be on: "A World at War and the Postwar Era".

The Dayton Branch is sponsoring the meeting and has extended an invitation to all members of the engineering and technical societies in the Region to attend.

LOS ANGELES BRANCH

Los Angeles Branch A.E.S., opened the 1943-44 season with an open meeting for members and non-members on the night of September 13. The Southern California metal finishing industry responded enthusiastically to the invitation by attending in record numbers.

When the roll was called in the Rosslyn Hotel dining room, *President Emmette R. Holman* announced an attendance of 72, including 23 guests. Particularly gratifying, Holman declared, was the presence of many industry members who are active in the metal finishing, heat-treating and processing divisions of various airplane fac-

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The electrodeposition of Palladium on base metals has found many uses in a number of industries. Copper, brass, silver etc. can be plated with coatings of .00001" thicknesses at reasonable cost.

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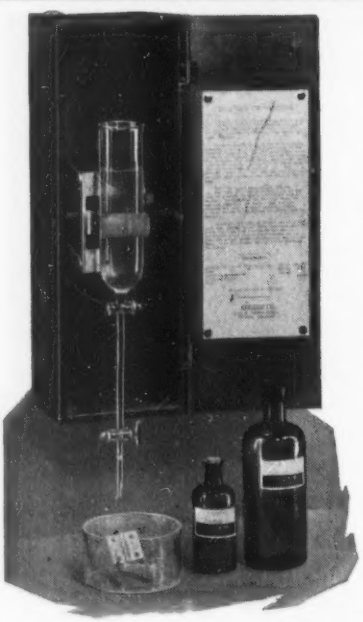

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tories and other defense plants. The guests included:

Donald Clark, chemist, *C. L. Wilson*, plating foreman, and *A. T. Cram*, plater, of *Bendix Aviation, Inc.; H. Brelinger*, research chemist, and *E. Wilds* of *Adel Precision Products Co.; John F. Beall, Harshaw Chemical Co.; A. C. Allen* and *A. E. Shumate* of the Naval Inspection Service; *R. B. Strathbean*, research chemist, and *George Coobrough* and *C. H. Wells*, plating supervisors at *North American Aviation Corp.; S. F. Hill*, president, *Hill Electric Co.; Edward H. Hoyt*, production engineer, *Pacific Enameling & Plating Co.; Fred D. Moore*, proprietor, *Renu Plating Co.; E. R. Brame, Thompson Products Co.; C. Stickley, M. L. Rimmer, E. Ray Miller* and *Ralph Wheeler* of *Turco Products, Inc.; G. R. Makepeace*, chemist, *Menasco Manufacturing Co.; A. L. Spezer, Collins Engineering Co.; Dean Williams, Northrup Aviation, Inc.*

The educational program opened with a talk by *F. Carl Hirdler*, research chemist, *Turco Products, Inc.*, Los Angeles, on "Accelerated Corrosion Tests for Electroplated Coatings."

The speaker cited the changes which have taken place in plating policy and practice since the war began. Before the war, he pointed out, plating generally was influenced by the desire for ornamentation, shine and luster to satisfy eye-appeal. For the duration of the war, Hirdler declared, it is necessary to conserve strategic metals wherever possible and plating for appearance has given way to plating for corrosion resistance. Metal finishers now must disregard the eye-appeal and ornamental factors and do their plating according to Army and Navy specifications which emphasize corrosion resistance.

In making accelerated corrosion tests, Hirdler declared, it is important to consider the problems individually as they apply to the metal to be tested, taking into careful consideration as well the climate in that part of the world in which the part being tested will perform its duty. For instance, airplane parts for planes destined for operation in the South Pacific theater of war, where they will be subjected to considerable salt water, should be given corrosion tests differing materially from the tests applied to plane parts which will see use in desert war zones.

Hirdler declared that the salt-spray method is now one of the most important methods of corrosion testing. Other methods which he touched upon in his talk were the weather-ometer, salt and peroxide, seawater, acid fume, hot-and-cold alternate test and the test which involves burying the part in the ground.

The second talk of the evening was given by *Gerald R. Makepeace*, chemist in the metallurgical laboratory of the *Menasco Manufacturing Co.*, Burbank, Calif., in which the speaker presented the results of an investigation conducted in the Menasco laboratory of the effects of various bright dips applied to zinc plates toward corrosion prevention as measured by the standard salt spray.

He explained that at present many industries are being forced to replace cadmium

plating with zinc plating for lack of cadmium. In the hurried change-over at the Menasco plant, he said, it was discovered that some pertinent data were missing concerning the relative corrosion resistance of zinc plates which had been bright dipped by various means after plating.

The bath used for the Menasco tests was a bright zinc described in a recent issue of the *Plating and Finishing Guidebook*. The one difficulty, Makepeace stated, came from the fact that when a zinc plated part is removed from the solution, it is covered with a thin, yellowish-brown film which can not be removed by a water rinse; but it was found that the film could be removed by a quick dip of the part in a very dilute solution of nitric acid, after which the plate appears bright and lustrous. If the plate is not dipped in nitric acid but is dipped directly into the chromic acid following the water rinse after plating, he said, the yellowish-brown film is darkened slightly.

Makepeace submitted various metal samples which had been put through the tests. The samples shown included small plates which had been tested in salt spray for 72 hours after receiving .00025″ zinc plate; 200 hours in salt spray with .00026″ zinc plate; 200 hours in salt spray after receiving .00075″ zinc plate and a nitric acid dip, and 200 hours in salt spray with .00075″ zinc plate, nitric and chromic acid dips.

Makepeace announced that conclusions reached upon completion of the tests were that for the best possible corrosion resistance, zinc plated parts made of chrome-moly steel should be dipped only in the chromic acid bath after plating, as per Specification AN-P-32, and that the nitric acid dip is detrimental to the process where corrosion resistance is of prime importance.

Society of Automotive Engineers

Metal coating can be used to renew many worn parts of a heavy-duty motor truck chassis by expenditure of only a few pounds of wire, thereby saving costly delays and conserving several pounds of strategic material in the form of replacement parts ordinarily installed, *Robert N. Reinhard,* Los Angeles, chairman of the committee on metal coating, application and technique of the West Coast Branch, Society of Automotive Engineers, set forth in a recent talk on "Molten Metal Replaces Wear."

Reinhard, who as manager of the Los Angeles Automotive Works, has demonstrated the practical value of the practices explained in his talk, presented a list of equipment required for metal spraying of automotive parts, went into detail concerning how the process of metal spraying a bearing journal should be handled, cited advantages of the spray method, and cited a list of costs for spraying typical automotive parts that are being successfully reclaimed and renewed by use of metal coating.

A recent program of the West Coast Transportation and Maintenance meeting of the Society of Automotive Engineers at San Francisco included a paper on "Metal Spraying" by *J. W. Caughy* of the *Precision Engineering Co. C. A. MacGilliviray* of the *Eutectic Welding Co.*, talked on "Eutectic Welding Alloys."

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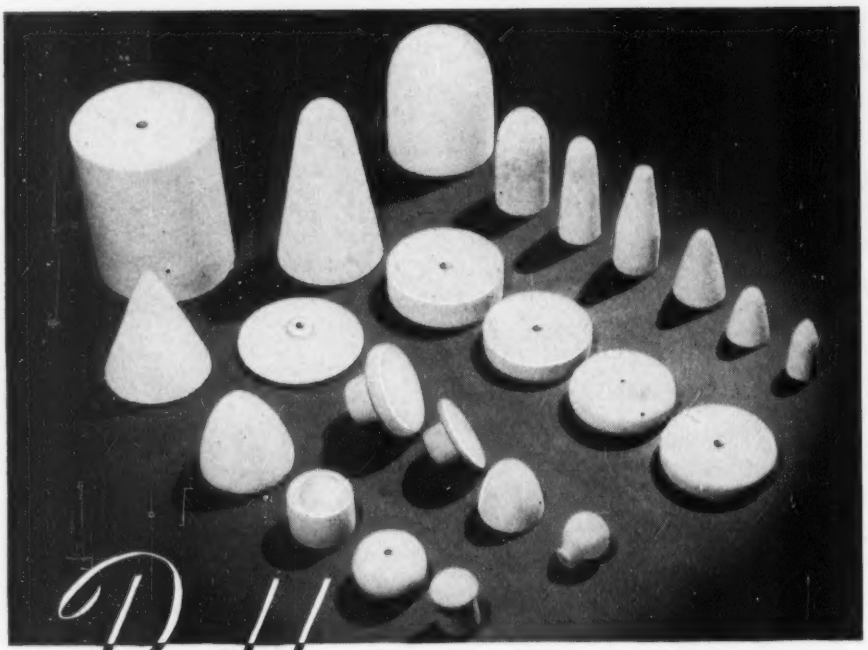

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(*Concluded from page* 630)

Treeing is of at least two definite types. One type is successive nodularization. The other type of treeing occurs in deposits made in simple solutions particularly with metals exhibiting cubic crystal structures. Crystal growth occurs predominantly in a two-dimensional plane due to low discharge potentials of the ions at low polarization. This type of treeing is shown in deposits of silver and lead from simple solutions.

In conclusion, the writer would like to state that the obtaining of good photomicrographs of plated structures is not easy. Much patience, skill and ingenuity are needed. If a clear structure is not obtained during etching, the specimen must usually be repolished on 0000 paper and the laps, because of differential etching, particularly with multiple coatings. Often this may be repeated several times. However, this work may be rewarded by the ability to diagnose plating difficulties by means of good microscopic technique. The causes of roughness in plated and hot-galvanized coatings, porosity, cracking, brightness, alloying, diffusion and peeling are frequently indicated by microscopic study. The works of Castell, Anderson, Lewis and Oplinger on the diffusion of copper deposits into zinc base die castings and the effects of cleaning and acid dipping on this diffusion which leads to blistering are excellent examples of the fruits of microscopy—and there are many others.

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Rounding corners or removing burrs by grinding or filing is too slow and costly to meet today's demands for speed and economy.
Barrel finishing has solved many such problems. Write to us about yours and send a few unfinished samples of your small, metal parts. We'll gladly tell you if they're adapted to finishing with Abbott barrels and materials.
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(*Concluded from page* 633)

higher pH and (2) the hydrogen ion concentration is lower. However, the corrosion rate of the metals, such as zinc, which form amphoteric hydroxides, is increased markedly by an increase in pH value. The pH value also generally has a more pronounced effect on the hydrogen evolution type of corrosion (reaction 7) in the acid range of pH values than on the oxygen absorption type of corrosion (reaction 8).

The corrosiveness of a natural fresh water with a pH of 7-8 usually is much less than that of sea water with a pH of 8.0. The difference is due to the presence of much more mineral matter (salts) etc. in sea water.

Obituary

Hugh A. Todd

Hugh A. Todd, affectionately known to his associates as Hughie or "No. 7", passed away on July 31, 1943 after an illness which lasted several months, during which he had been living with his son-in-law and daughter, Mr. and Mrs. John J. Knodel, of Rumson, N. J.

Hugh A. Todd was one of the pioneer figures in the Hanson-Van Winkle-Munning Company and in the plating industry of the East. More than 40 years of his life had been spent in the industry, starting with the predecessor companies which now form the Hanson-Van Winkle-Munning Company. For many years past he had been New York State representative for them with headquarters at Syracuse, in which he capably supervised the sales of their products throughout upper New York State.

Hughie leaves a veritable host of friends in the company, among his customers and throughout the industry. All will miss him.

His work is now being carried on under the capable guidance of Robert M. Morton.

New Book

The Fundamentals of Electrochemistry and Electrodeposition. By Samuel Glasstone. Published by American Electroplaters' Soc., New York, N. Y. 1943. 90 pp. Price: $2.00.

This book is a compilation of a series of monthly articles originally published in *The Monthly Review.* Chemists and engineers will probably find that the material is mostly a duplication of that which will be found in a number of books in their libraries, but platers who are interested in the theories upon which electrodeposition is based and who do not have any books on electrochemistry may use this as a basic textbook. However, as stated by the author in the preface, an elementary knowledge of chemistry and physics is necessary for proper appreciation of the subject.

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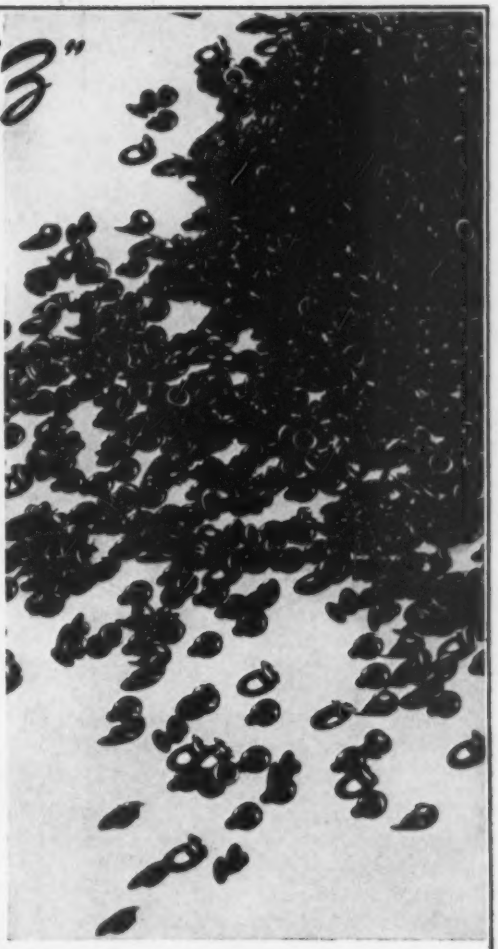
has blackened millions of zinc eyelets and grommets



Blackening of Zinc is Easy with Ebonol "Z". Tumbled about for 3 minutes in an 8 oz./gal. solution of Ebonol "Z" salts, zinc eyelets are given a beautiful adherent black coating of molybdenum sesquioxide.

Ebonol "Z" can be applied to sheet zinc, zinc alloys, hot-galvanized and electroplated zinc. It removes very little zinc (about 0.00002") and costs about ½c per square foot for materials.

Any metal can be blackened by zinc plating and blackening with Ebonol "Z".

Ebonol "Z" is an ideal method of preparing zinc surfaces for enameling and lacquering.

OTHER BLACKENING PROCESSES

Ebonol "S"—A one bath process for blackening steel and cast iron.
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News from California
By FRED A. HERR

The Alvey-Ferguson Co. of California has been formed at Los Angeles with sales offices, engineering and manufacturing facilities located in a 150,000 sq. ft. building at Santa Fe and Slauson Ave. The new firm, which is affiliated with Alvey-Ferguson Co. of Cincinnati, O., manufactures metal products, cleaning and finishing equipment and conveying equipment.

Officers are *John C. Walter*, Cincinnati, president; *Charles R. Fleishman*, Los Angeles, vice-president, and *A. J. Bayer* and *Walter Colton* of Los Angeles and *Jayne B. Walter*, Cincinnati, directors. For the past 20 years, Fleishman has been vice-president of the *A. & F. Aluminum Products Co.* and secretary of A. J. Bayer Co. of Los Angeles, manufacturers of pressed steel and various types of metal fabrication.

S. A. Richards has been named to the newly created post of plant buyer for *Thompson Products, Inc.*, 8354 Wilcox Ave., Los Angeles, makers of aviation pumps and other defense items. He came to the firm's West Coast branch after three years' service in the Cleveland, O., purchasing department.

Lawrence Retulo, head of the *Los Angeles Plating Co.*, reports work is under way on a new brick addition to his plant at 6921 South Avalon Blvd., Los Angeles, in which overflow production and administrative activities will be housed. Cost of the project will be approximately $10,000. The firm does considerable zinc plating, hard chroming and anodizing to government specifications and is a United Chromium licensee.

Atomized Metals Co. of San Francisco, which has been one of the leaders in the metal spraying field in Northern California for the past eight years, has switched to a double-shift, 18-hour daily work schedule in order to handle increasing business in metal spraying truck and automotive parts. *J. Russell Kelly*, company head, reports the shop handled about 2,000 spray jobs on trucks and pleasure cars during the past 12 months. The firm has specialized in metal spraying crankshafts and bearing surfaces, using processes that are reported to have reduced spraying time and increased the precision angles on the jobs.

Pacific Mining Co. is constructing a plant at the old Union mine near San Andreas, Calif., for treatment of approximately 600,000 tons of copper tailings. It is estimated about 500,000 pounds of copper can be recovered.

Aluminum will be the leading metal of the future in the opinion of *Dr. Harold A. Levey* of New Orleans, nationally known chemical and research engineer, who stated during a recent visit to Los Angeles that because of its low cost and workability, aluminum will figure more widely in future developments than any other metal.

Dr. Levey stated that metallurgists estimate that aluminum, which cost 25 to 27c a pound in ingots before the war, will sell for 9c a pound after the war because of the spectacular increase in production which has been taking place during the past two years. He predicted the combination of aluminum with plastics in the manufacture of items subject to much handling, which will confront metal finishers with some new and interesting problems in polishing.

"Aluminum is a conductor of heat," Dr. Levey explained, "which means that desk tops and door knobs made of aluminum would be cold to the hand in winter and uncomfortably hot to the touch in summer. This calls for plastics, which also will be used more and more in structural work and coverings."

Garvey Machine & Die Casting Co., 1505 Garvey Blvd., Garvey, Calif., is constructing two wing additions to its shop building.

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Just a Reminder

That The Plating Equipment & Supply Co.

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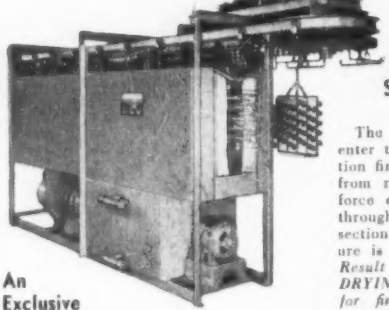


An Exclusive Metalwash Development

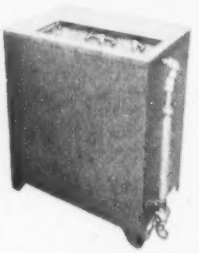
Overhead Horizontal Return Type Single Tunnel DRYER

The cold rinsed racks enter the cold blast section first, stripping water from rack and work by force of blast, following through to the hot blast section where all moisture is evaporated. *Result is SPOTLESS DRYING so desirable for finished work.* Consult us without obligation. Ask for Folder MF.

Foot Controlled Cold Spray Rinse UNIT

Sharp cutting sprays brush downward from all sides; quickly remove hard-to-rinse plating solutions.

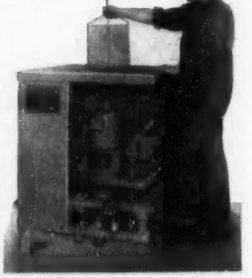
Unit can also be furnished for hot water with extra foot pedal valve.



Motorized Spray Rinse UNIT

For difficult rinse jobs, where water is less plentiful and low in pressure.

When operator steps away, water and electric current shuts off automatically.



METALWASH MACHINERY CO.

149-155 Shaw Avenue Irvington, N. J.

"Liver-of-sulphur" and "chromic acid" ran a dead heat in a recent discussion which arose among a group of Los Angeles platers concerning which was the more effective method for stripping copper deposits off steel gears on which the teeth had been stopped off for case-hardening. Five of the debaters favored liver-of-sulphur and cited "Sulphur Mac" McKeon as their authority. Five others went to bat for chromic acid ". . . no matter how thick the copper is."

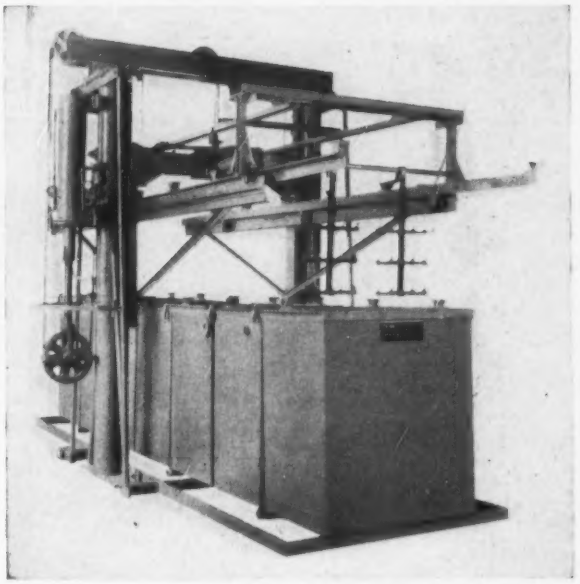
Another subject which elicited considerable comment in the group concerned the type of acid which should be used in conjunction with phosphoric acid for etching cold-rolled steel. Consensus of opinions was that 85% phosphoric acid will give excellent results, but if greater speed in etching is desired, one of the mineral acids should be used. It was agreed that if time is no object in the etching job, phosphoric acid can be used effectively.

Palace Plating Works, 710 East 29th St., Los Angeles, has installed a new 300-gallon chrome tank and auxiliary equipment for use on present war contracts involving airplane fittings. The firm is also equipped for handling gold, silver, nickel and cadmium work.

Fred D. Moore's Renu Plating Co., 1531 East 32nd St., Los Angeles, has geared its production schedule exclusively to cadmium work on airplane parts handled on a subcontract basis for *Pacific Enameling & Plating Co.* and other Southern California companies. Moore has operated at the 32nd Street location for the past 11 years. Part of the time he was in partnership with the late Ed Bathhurst and since Ed's death several years ago has operated the firm himself. Renu, incidentally, is one of the oldest names in Southern California plating, having been operated by Bathhurst and *Ernest W. Francis* as far back as 1908.

F. Carl Hirdler, process engineer in the Los Angeles research laboratory of *Turco Products, Inc.*, left Los Angeles on September 15 on a business trip for Turco which was expected to cover 7,000 miles between mid-September and November 15. Hirdler described the trip as being for the purpose of engineering trouble-shooting. He will visit plating, polishing and enameling plants in more than 30 cities, including Akron, St. Louis, Kansas City, Chicago, Cleveland, Detroit, Indianapolis, Columbus, Cincinnati and others in the Middlewest and East. His plans called for doing most of the traveling by plane.

Crown Pick-up Unit



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FOR A SERIES OF OPERATIONS WHERE THE WORK MUST PASS THROUGH SEVERAL TANKS, AS THE CLEANING AND RINSING OPERATIONS, FOR A SEMI-AUTOMATIC PLATING TANK.

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POSSIBLE TO PRODUCE
Sold in LUMP and LIQUID FORMS by Leading Plater Supply Houses
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SCREWS-RIVETS-WASHERS
SMALL PARTS, ETC.
THE CHROMIUM PROCESS CO.
Shelton, Conn.

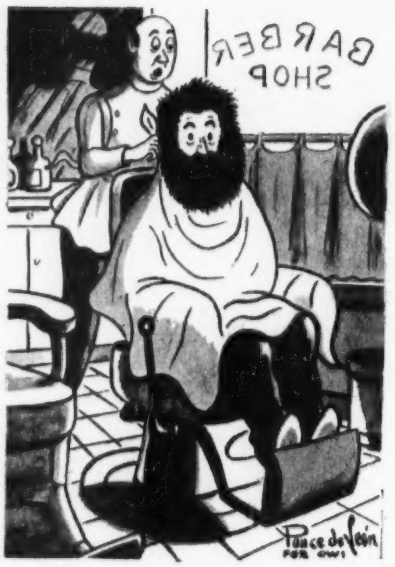
Willard Shuler has resigned as plating superintendent of *Bendix Aviation, Ltd.*, North Hollywood, Calif., and has taken over the job of superintendent of plating for *Pacific Aviation, Inc.*, Los Angeles. *C. L. Wilson*, heat treating engineer for Bendix, has been vested with the additional duties of superintendent of plating. *David Brown* has been promoted to process and production engineer for the Bendix Co.

Precision Screw Products Co., 5202 Alhambra Ave., Los Angeles, is erecting a 40 x 85 foot addition at a cost of $8,500.

Calvin B. Morris and *Walter A. Stallfort* have received articles of incorporation for the *Long Beach Plating Co.* and are operating from a plant at 2382 American Ave., Long Beach.

Wayne Enameling & Plating Corp., has been incorporated in Los Angeles with capital stock of $10,000. Listed as directors are *Donald E. Mathews, Garnet C. Rainey* and *Barbara King*, Quinby Building, Los Angeles.

Gilfillan Bros., Inc., have construction under way on an addition to their plating department at 1815 Venice Blvd., Los Angeles.



"Been working much overtime lately, Mr. Schuster?"

U. S. Spring & Bumper Co. now working on armament for the new P-51 Mustang, the Flying Fortress, Liberator, Catalina, Mitchell and Avenger planes, gun shields for Army and Navy guns, and springs for jeeps and half-tracks.

An addition is being built to the *Ferro-Spec Laboratories*, 3370 East Randolph St., Huntington Park, Calif.

H. Darwin Kirschman of the *Montgomery & Pomeroy Co.*, chemical consultants, Pasadena, has been named instructor of a free, eight-week, night class in industrial quantitative analysis offered as a war training course by the University of California at Los Angeles during September and October. Chemical laboratory training is also included in the course.

Notices of intention of engaging in business under the following firm names have been filed:

Mission Plating Works, 2053 Violet St., Los Angeles; *J. E. Huff* and *Eston D. Anderson.*

Trimal Laboratories, 7161 Beverly Blvd., Los Angeles; *J. W. Morrow.*

Affiliated Metal Products Co., 500 Aliso St., Los Angeles, *Joseph A. Alperson.*

Die Bold, Inc., capital stock $180,000, Ohio corporation; California agency designated to *Joseph C. Cannon*, Los Angeles.

American Sandblast Co., 2430 East 55th St., Los Angeles; *Glenn A. Wunderlich* and *Wilbur C. Diamond.*

Pasadena Research Laboratory, 2107 East Villa St., Pasadena; incorporation papers received. *John E. Gregory.*

Scientific Service Laboratories, 2219 So. Hoover St., Los Angeles; *John A. Orme, Edwin A. Anderson* and *Leo A. Bullars.*

Coast Chemical Co., 8745 Sunset Blvd., Hollywood; *Samuel A. Cariat.*

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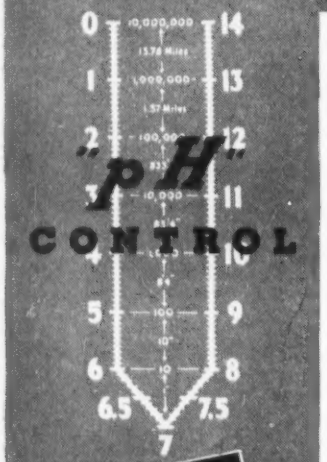
SCIENTIFIC CLEANING THROUGH pH CONTROL



pH Control is the new method which has replaced guesswork with science in the manufacture and dispensing of industrial cleaning materials—provides the key to scientific cleaning

KELITE KDL No. 1

Best for Al and Mg

Kelite KDL No. 1 cleans rapidly, yet it cannot harm aluminum or magnesium. Test pieces processed in solutions of KDL No. 1 (at concentrations and temperatures far greater than necessary for successful cleaning) show absolutely no sign of attack or loss of weight.

The peak pH of this material is 100% safe for aluminum and magnesium. And, in order to increase the efficiency of subsequent operations such as anodizing and spot welding, Kelite KDL No. 1 rinses free.

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Company _____

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No. 1

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for the

ELECTROPLATER and ELECTROTYPER

As an aid in the control of plating baths of

NICKEL, ACID ZINC, TIN, CYANIDE

ACID COPPER, CADMIUM, BRASS and BRONZE

LaMotte Block Comparators

for pH tests to accurately control the acidity and alkalinity of nickel, zinc, tin or cyanide baths. Inexpensive and easy to operate. A test can be made in a few minutes.

LaMotte Acid-Copper Analytical Set

for accurately determining and regulating the acid and copper content of the bath to insure uniform results.

Other LaMotte Outfits for determining Chlorides, Nickel Content, Iron Content and positive control of Cyanide Copper, Acid Zinc, Cyanide Zinc, Cadmium, Brass and Bronze plating solutions.

Write for further information.

LaMOTTE CHEMICAL PRODUCTS CO.

Originators of the Practical Application of pH Control

DEPT. MF TOWSON, BALTIMORE, MD.

Adell Precision Products Corp. is expanding its production facilities through the addition of two factory buildings to its plant at 10,777 Van Owen St., North Hollywood, Calif.

Recent developments on the West Coast in the production of various metals in which electroplaters have a vital interest are briefed below:

TIN: Considerable quantities of high-grade ore are reported to have been uncovered recently in exploration work near the site of an old tin mine southwest of Corona, Calif., which was first developed by an English syndicate in the 1880's. For the past two months *Dodge Construction Co.*, with *Ray I. Biggy*, superintendent, acting as agent for Metals Reserve Agency of Washington, has been making tests over the available acreage east and south of Corona. A test mill has been installed and is ready for operation. Much ore is reported in sight, both in the old workings which have been reopened and in nearby territory stretching toward the Gavilan Hills.

CHROME: *Rustless Mining Corp.*, with operations in Glenn County, Calif., is now reported to be the largest chromite producer in California, with huge ore deposits exposed. The property was reopened in 1940 after 22 years of idleness.

Sundown Mining Co. has completed a new access road to its Bucks Lake chrome deposits near Quincy, Calif., and is now making regular shipments. Steady chrome production is also reported from the Rock Creek mine in the Quincy district.

TUNGSTEN: A rich deposit of tungsten ore has been discovered in the Bloody Run field near Winnemucca, Nev., and is said to assay higher than 46% scheelite. Ore exposed in shallow workings is reported to be worth $1,500 a ton.

U. S. Tungsten Co. has leased property near Big Pine, Calif., as the site for a 50-ton tungsten mill, which will run ore from the company's tungsten mine five miles west of Big Pine.

Reconstruction Finance Corp. has approved a $30,000 loan to *Gold Hill Dredging Corp.* for production of tungsten ore 11 miles west of Quartzite, Ariz., where plans for erection of a mill are under way.

COPPER: Equipment is being installed in the Penn copper mine near Angels' Camp, Calif., for dewatering of underground workings preparatory to resumption of ore recovery. This 90-year-old property was formerly operated by Penn Chemical Co. and is now reported under control of a major mining corporation.

Henry V. Snell of Los Angeles and *J. L. Augustin* of Lordsburg, Ariz., report that the Atwood copper mine in the Lordsburg district is being brought into production. Ore bodies were proved by a diamond drilling campaign conducted by the U. S. Bureau of Mines.

ANTIMONY: *Alma D. Prieste* of Los Angeles has announced plans for development of the Fencemaker and three adjacent antimony properties 20 miles south of Lovelock, Nev. Nearly all ore exposed in the claims is stibnite, the sulfide of antimony.

Discovery of a deposit of zinkenite, an unusual combination of antimony and lead, is reported to have been made in the Red Bird cinnabar mine in the Antelope Springs district of Nevada. The ore is likewise reported to contain lead carbonates, lead oxides and galena, as well as some minerals never before reported from a Nevada property.

MANGANESE: Two manganese showings in the Globe, Ariz., district were placed in production in August. These included Mineral Farms No. 2 by *G. R. Mahaffey* of Dallas, Tex., and Mineral Farms No. 4 by *F. A. Bennett* of Globe, Ore., which is reported to run 25-34% manganese.

MERCURY: Production of mercury is expanding in the cinnabar belt of Napa, Sonoma, Lake and Colusa counties in California where several new properties were placed in operation in recent months.

VANADIUM: Production has gotten under way at the Carrizo Mountain Vanadium Mine in the Holbrook, Ariz., area. Principals in the venture are *John Wade* of Farmington, N. M., and *T. F. V. Curran* of Pittsburgh, Pa., who operate as *Wade, Curran & Co.*

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POLISHING COMPOUNDS 4A symbolizes SUPERB PERFORMANCE, which you will find in our compounds for CUTTING, CUT AND COLOR, AND MIRROR FINISHING all kinds of steel including stainless steel, carbon steels and hard-to-buff alloys.

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4A CEMENT and THINNER Used for setting-up wheels, belts, buffs, rolls—they are free cutting, long lasting and economical when set up with 4A Cement.

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Pickle Assistant No. 21

Use it to increase the speed of pickling . . . eliminate rejects . . . save acid . . . reduce pitting and etching to a minimum.

***Pickle Assistant No. 21* effectively blankets fumes . . . is completely soluble and stable in concentrated muriatic acid and all dilutions . . . assures "protective" action on ferrous metals**

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THE **Chemical** CORPORATION
93 Broad St. Springfield, Mass.

Business Items

Vernon Julianne

Vernon Julianne has been promoted to the position of Plating Superintendent of the *International Resistance Co.*, 401 N. Broad St., Philadelphia, Pa.

The Park Chemical Co., Detroit Mich., has announced the recent appointment of *Richard Hammerstein* and *T. J. Clark* to its engineering staff.

Mr. Hammerstein has been associated with industrial metallurgy, in both the research and experimental divisions of the Carnegie Illinois Steel Corp., The Crucible Steel Co. of America and Oldsmobile.

Mr. Clark has specialized in heat treating, having held positions with R.C.A. Manufacturing Co. and the Brown Instrument Co.

Both men will be service engineers in the heat treating division of Park.

Robert A. Emmett, president and chairman of the board of *Detroit Rex Products Co.*, metal cleaning engineers, has announced that *"Detrex Corporation"* replaces Detroit Rex Products Company as the new firm name. No changes in ownership, company policy or management will be made.

This company, which manufactures degreasers, alkali and petroleum spirits washers and emulsion cleaners, degreasing solvents and alkali cleaning compounds was established in January, 1920.

The growth of the firm, now over seventy times its original size in combined floor space, is the result of years of development and research by chemists, technicians and service engineers. Various metal cleaning applications have been designed and installed, and are especially important to industrial plants concentrating on speedy production of war materials.

The trade name "Detrex"—a word now recognized in the metal cleaning industry —is therefore particularly significant in the new title.

MacDermid, Inc., manufacturer of metal cleaners, Waterbury, Conn., announces the appointment of *Harold Leever* as sales manager. Mr. Leever was formerly western manager, residing in Ferndale, Mich., but will now make his headquarters in Waterbury. *W. D. MacDermid*, former sales manager, is no longer connected with the company.

R. H. Hathaway, formerly assistant chief engineer for *Hammond Machinery Builders, Inc.*, has joined the *Packer Machine Co.*, Meriden, Conn.

R. H. Hathaway

99% + PURE!

NICHOLS

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TRADE MARK REG. U. S. PAT OFF.

COPPER SULPHATE

OLDEST AND BEST KNOWN BRAND

Triangle Brand Copper Sulphate has been the standard in the chemical industry for over 50 years. *Every shipment is of consistently high quality—over 99% pure!*

Triangle Brand is readily available from strategically located plants. It is manufactured in several convenient sizes to meet varying consumer requirements. Packed in especially designed containers. Write for details.

COPPER OXIDE (Red) NICKEL SULPHATE

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PHELPS DODGE REFINING CORPORATION

Electrolytic Refiners of Copper

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McKeon's

"Liquid Sulphur"

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REMOVES COPPER

(FOOL PROOF)

Questions welcomed.

Send for FREE sample.

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Greensburg, Pa.

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BUFFING and BURRING COMPOUNDS ASSURE

The Best Quality, Correct and Uniformly controlled manufacturing, Fair Price Policy, and Special Formulas for Individual Demands.

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BURRING COMPOUNDS ..... All types
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TRIPOLI ..... Numerous grades
EMERY PASTE ..... All size grains
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GREASE STICKS .... For better efficiency
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STRATFORD CONNECTICUT

INDIAN BRAND
POLISHING ABRASIVE

A new type, long wearing, economical abrasive grain. Perfected and introduced by us as a substitute for imported Turkish Emery. Leading defense plants now using large quantities for essential war-work, report excellent results.

Send for trial lot—Free

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EMERY & CORUNDUM COMPANY
Established 1904
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Established 1901

ORIENTAL ROUGE CO., INC.

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ALUMINUM: cutting and coloring compounds.
STAINLESS STEEL: a complete line of cutting and coloring compositions.
STERLING and SILVER PLATE: Rouges to fit your particular job.

We invite your inquiry.

The board of directors of *The Procter & Gamble Co.*, Cincinnati, O., have announced the election of *Thomas J. Wood* as vice president in charge of sales, and a director of the company. He fills the vacancy caused by the death of Clarence J. Huff.

Mr. Wood joined the company in 1919 as salesman in the St. Louis district. He served in sales supervisory capacities in the company's western division and became manager of the Kansas City district office in 1923. Five years later he was promoted to Western division manager, and in 1938 was named general sales manager.

Dr. Albert Fiedler

The Milburn Co., 3246 E. Woodbridge Ave., Detroit, Mich., producer of products for the prevention of industrial dermatitis, has announced the appointment of *Dr. Albert Fiedler* as director of research, in charge of the new laboratory.

Dr. Fiedler specialized in organic chemistry at Columbia University and the University of Berlin. Among the posts he has held were that of research chemist for the Celluloid Company, Newark, N.J.; plant superintendent and director of research for the Eagle Rock Manufacturing Co., and a similar position at the Empire Laboratories, New York, N. Y. Just previous to his affiliation with the Milburn Co., he was head of the technical and research department of Annabolic Fords, Inc., Glendale, Cal.

Armin L. Nevers has been appointed by *The Osborn Manufacturing Co.*, Cleveland, O., manufacturer of power brushing wheels, as its technical representative in the state of Wisconsin, following through in the development of a territory in which he has already had many years of sales experience.

Mr. Nevers recently completed a several months' period of special training in the Osborn factory where he became informed on the design, manufacture and application of the company's many products.

FOR
HARD CHROMIUM
USE
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ADDITION AGENTS

to obtain

1. Finer grain structure
2. More durable plate
3. Smoother heavy plate
4. Greater throwing power
5. Less sensitivity to sulphate ratio.

Send a sample of your present bath to see if it is suitable for conversion to this improved formula.

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VULCAN SODIUM STANNATE

Manufactured by

THE VULCAN DETINNING CO.
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Under Patents Nos. 1,575,217 and 1,708,392

FOR TIN ELECTROPLATING

SALES AGENT

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STEEL BALLS
Best for Burnishing . . . Perfect for Polishing. No culls, no cracks.
Mixtures as Required
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A big drop in the number of rejects were noticed by metal fabricators when provided with a cleaner that really cleans the surface of metal prior to plating or finishing.

PERMAG Cleaning Compounds

were developed to produce a chemically clean surface, without injury to the metal. They also achieved marked successes for over 20 years on other difficult cleaning jobs—Economical, efficient, quick acting PERMAG Compounds are in wide demand, especially in war material producing plants.

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Manufacturers of Specialized Scientific Cleaning Compounds

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Nationally Represented. Warehouses in principal cities.
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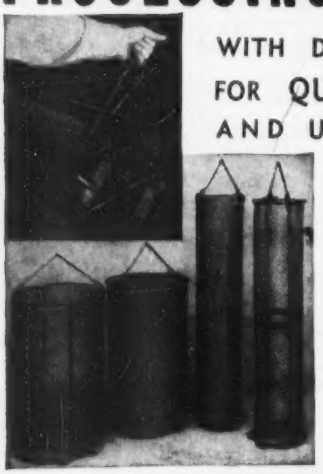
PROCESSING CARRIERS

WITH DROP-BOTTOM FEATURE FOR QUICK QUENCH . . . AND UNIFORM RESULTS



Rods equal in length to basket depth are immersed in 900° liquid salt bath, then, by unlatching drop-bottom are speedily quenched. Removable pipe is placed over latch for greater leverage and protection of operator. Write Rolock engineers for specially designed crates, baskets, trays or fixtures to solve YOUR problems. Built to withstand any exposures, and for loads to 3 tons.

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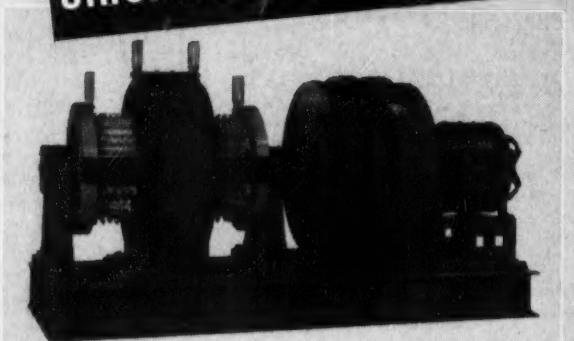
COLUMBIA MOTOR GENERATORS
for Electroplating and other Electrolytic Processes



Columbia Generators embody every feature essential for dependable, 24-hour operation. They are built for electroplating service in sizes of 6 to 20 volts, 500 to 20,000 amperes, for anodic treatment of aluminum in sizes of 40, 50, and 60 volts, 500 to 3,000 amperes. Columbia Generators for other electrolytic processes range from ½ to 250 KW, 100 to 40,000 amperes, 6 to 60 volts.

Prompt shipment can be made on any type and size. Write for full information.

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave., N. E. • Cleveland 14, Ohio

OCTOBER, 1943

ORGANIC FINISHING

SECTION OF METAL FINISHING

LACQUERING • ENAMELING • JAPANNING • PAINTING

IT'S THE FINISH

THAT COUNTS . .

. . not in the Drum

In war, in peace, it's the finish that counts. But it's *on the job* that it counts—not in the drum or pail. An excellent finish in the container may not be best in production or in improving your product. And so much hangs on even a little finish.

Cost is an important feature of finish yet the finish that is low in price in the drum may be expensive on the finished article. Savings in the drum may have been dissipated along the production line, or may be wiped out when the critical eye of the customer makes a comparison with competitive products. There are too many factors in finish to take a chance. This test should be applied—

Will the finish in the drum meet the requirements of the finish in application and on the job?

THE PART OF SYNERGISM

That's why we stress synergism at Zapon, in specifying finishes and finishing procedures. Synergism—cooperation plus—between the finish manufacturer, the designer and the product manufacturer helps make certain that the finish *on the job* will give protection, appearance, more finish mileage and lower costs.

Synergism pays. Other manufacturers have found that out. We suggest you get in touch with one of our offices and we'll get together synergistically.

WHAT IS SYNERGISM?
In Synergism, forces—minds—work together to produce results greater than both working separately might achieve, making 2 + 2 = 5.

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Founded January, 1903
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ORGANIC FINISHING

SECTION OF METAL FINISHING

OCTOBER, 1943

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Cover Photograph

Coating incendiary bomb cases.
Courtesy Paasche Airbrush Co.

De-icing Airplanes

The use of finishes for functional purposes and interest in this field have increased greatly in the past two or three years, due in most part to the war. In addition to the familiar functional uses of finishes such as for camouflage, warning, identification, etc., there are numerous other less well known applications where protection or decoration are not the only considerations. Some of these are in actual use while others are still in various stages of development.

One of the most interesting functional uses of finishes that has come to our attention is in connection with the de-icing of airplanes. As we all know, ice forms on airplanes in flight under certain conditions. This ice can be a serious hazard and several methods for its removal, including hot air blasts, pulsating rubber skins, etc., have been used. These and other similar means of removing the ice have the disadvantage of all mechanical contrivances, namely, the disadvantage of a greater or lesser number of working parts which may fail.

A new approach to the problem is through the use of specially formulated organic finishes to be applied to those areas on which ice tends to form. Three types of materials have been proposed. One employs an anti-freeze fluid which continually exudes from the film. Another contains water soluble, freezing-point-lowering salts. The third is made with electrically conducting pigments which allow a current to be passed through the film. The manner in which each of these materials functions is quite obvious.

We are not prepared to say which of the above finishes is best for the purpose or whether or not any one of them could replace mechanical ice removers. Each finish has advantages and disadvantages, as does the idea itself. The important point as we see it is that the proposal to use a finish in de-icing airplanes is only another in a long list of possible applications for organic finishes which have come from the finishing industry. It is thinking of this kind which has kept the industry in its present important position.

L. H. LANGDON, *Publisher* • WILLOUGHBY G. SHEANE, *Associate Editor* • T. A. TRUMBOUR, *Business Manager*

"SPEC" COATINGS

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Strict specification requirements don't crowd out the touch of genius that goes into all Egyptian "spec" finishes.

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Take Egyptian's AXS-736 Rev 1 for cartridge cases, percussion primers and other steel surfaces . . . it's on the beam with the Ordnance Dept. and it fits your own set-up as though it were made to order for you. Extra hard, extra clear. Flexible in application. Dries for handling in 10 minutes. Bake at 350°F for half an hour, or 400°F for 20 minutes.

There's always a plus in an Egyptian Finish . . . for products of war or of peace.

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Special correspondence on finishing problems is invited.

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Egyptian's new U. S. Government "Spec" Book—4th Edition—is ready. It's helpful and it's FREE. Send for your copy. Please address Dept. C-10

EGYPTIAN FINISHES

EGYPTIAN

SUPERIOR FINISHES

NEWS FROM WASHINGTON—

By George W. Grupp
METAL FINISHING's Washington Correspondent

Industrial Alcohol From Pulp Waste The Ontario Paper Company Limited has begun to make industrial alcohol from pulp mill waste at its Thorold, (Ontario) Canada plant. It is estimated that it will produce about 600,000 gallons of industrial alcohol from such waste during the first year. This project is said to be the first alcohol plant on the North American continent to use pulp mill waste as a raw material. For years research on this method of alcohol production was conducted at McGill University of Montreal and at the Forest Products Laboratories of Ottawa.

Butyl Alcohol Pricing Methods Producers of butyl alcohol were given permission to use slight variations from the established methods of computing their average grain costs according to Amendment No. 8 to Maximum Price Regulation No. 37 as issued on August 20, 1943. All that is now required is that the producers submit their methods to the OPA for approval.

Contract Renegotiation Division Created On September 1, 1943 the War Department Price Adjustment Board set up a Renegotiation Division because of the increasing scope of the War Department's price renegotiation program. It is believed this new division, a Staff Division of the Army Service Forces, will increase the operating efficiency of this function of the War Department.

Ethyl Alcohol Order Amended For the purpose of having a more complete control over the distribution of ethyl alcohol, the War Production Board amended Allocation Order M-30 on August 19, 1943 to place the ordinary type of alcohol used for industrial purposes under allocation control on October 1, 1943. The amended order provides strict allocation on alcohol delivered to persons using 3,500 gallons per calendar quarter. Users of small quantities of alcohol are permitted to obtain such amounts without specific authorization from WPB.

Glycerin Restrictions Eased A limited amount of glycerin will be released beginning October 1, 1943 to manufacturers of protective coatings, the War Food Administration announced on September 6, 1943. Industrial users who wish to share in the quantity to be released should make application to the Fats and Oils Branch, Food Distribution Administration, Washington, 25, D. C.

Lacquer, Paint and Varnish Steel Drum Directive Through the medium of the National Paint, Varnish and Lacquer Association, the War Production Board has advised all manufacturers of lacquer, paint and varnish on September 9, 1943 to make sure that the best possible use is made of their present supply of steel shipping drums because of the limited supply of such containers for the packing of protective coatings. The manufacturers have been urged to get the full cooperation of their customers to return the drums for re-use. If a manufacturer has a contract with the War or Navy department, he should determine if new drums must be used in filling the order. This information can be obtained from the procurement officer with whom he is transacting business. If new drums are required then he should have the procurement officer see that he is supplied with the necessary new drums. On the other hand, if the orders for coatings are to be shipped in new drums to prime or subcontractors of the armed services, then the supply of such drums comes under CMP regulations, and he should indicate his drum requirements to his suppliers as far in advance as possible because drum fabricators must request their steel allotments 90 days in advance of production.

Linseed Oil Permissible Mark-Ups In the issuance of Amendment No. 5 to Maximum Price Regulation No. 53 on August 31, 1943, sellers of linseed oil, other than crushers, were permitted mark-ups. This amendment permits all sellers other than crushers to obtain their usual normal differential over the crusher's tank car price. This amendment also permits these sellers to add the actual cost of delivery where they customarily sold on an f.o.b. basis.

Mercury Restrictions Eased Conservation Order M-78, as amended September 9, 1943, removes from prohibited List "A" the use of mercury for the preparation of vermilion, marine anti-fouling paint and some other uses because of the increased production of this chemical and because the present stockpile is a fair margin of safety. The use of mercury for these purposes is now placed on List B with the allowable use restricted to certain percentages of the base period totals.

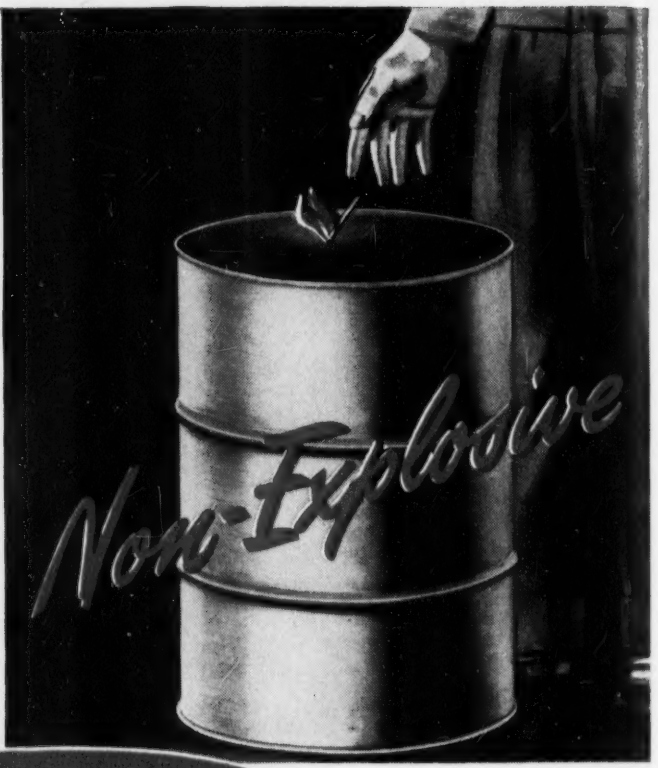
Mexican Turpentine Exports It was learned at the Department of Commerce that due to transportation difficulties and the inability to sell in certain markets due to the war, Mexico's exports of turpentine to the United States have been on the up-grade.

Oiticica Oil Industry of Brazil Expanding The shortage of Chinese tung oil has been a boom for the oiticica oil industry of Brazil. It was learned from the Department of Commerce that her exports of this oil rose from 3,717 metric tons in 1938 to 16,606 metric tons in 1941. The United States imports of this oil from Brazil rose from 3,086 metric tons in 1938 to 15,975 metric tons in 1941. In other words practically all of Brazil's export of oiticica oil is to the United States.

Priorities Regulation No. 5 Amended Priorities Regulation No. 5, as amended August 23, 1943, provides that anyone may now reproduce any WPB form, order, or regulation if the reproduction bears on its face the words "Information copy" or "Specimen copy" in 36 point caps or in hand lettering not less than one inch high. They may be reproduced by any process. If they are reproduced for filing with a government agency, then they must be of the official size and the same color of paper. Signatures of officials are banned from reproduction. The names of officials must be in type or print preceded by the word "(signed)".

Resin Restrictions Beginning September 1, 1943 the Chemicals Division of the WPB has ordered that no alkyd resins containing tung oil will be authorized for general use. However, exceptions will be made in the case of resins required for food container and closure linings and for insulating varnishes. Resins containing tung oil will not be denied for aircraft coatings (Specification AN-TT-P-656A) until November 30, 1943. Those who request allocations for phthalic alkyd resins under Order M-139 are asked to apply for tung oil alkyd resins only where such resins are required for the proper functioning of container and closure linings and insulating varnishes.

South Africa's Paint and Chemical Expansion The Union of South Africa, according to official reports, is now making for the first time such products as lactic acid, sulfonated oils, aluminum sulfate, cellulose lacquers and pigment finishes. The cultivation of tung trees has passed the experimental stage. The Union has 60,000 tung trees under cultivation.



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• **ARMOR-VIT** is the only fireproof, low-temperature, ceramic-type finish for metal products. In application, by spray gun, it is absolutely safe because being non-volatile there is no opportunity for fire or explosion. Once applied and in use, **ARMOR-VIT** withstands temperatures of 1800° F., or any temperature under 1000° F., for continual use.

More than this, **ARMOR-VIT** has exceptional resistance to thermal shock. It has been quenched in ice water from temperatures of 1600° F., and in reverse, has been plunged into boiling water after having been chilled to 150° sub-zero, without failure.

ARMOR-VIT is highly resistant to rust, corrosion, impact, scratch, abrasion, and abuse. It is available in olive-drab, gray and black. Its lusterless matte finish provides low reflectance and necessary camouflage. Being a priority-free finish, **ARMOR-VIT** is making it possible for some manufacturers to substitute iron or steel for the more critical metals such as chromium, zinc, nickel, cadmium, bronze, brass, tin, etc. Investigate **ARMOR-VIT** today. It has remarkable properties.

ARMOR-VIT DIVISION

Although ceramic in nature, there is no comparison between **ARMOR-VIT** *and porcelain enamel, paint, lacquer or synthetic finishes. It is non-volatile, non-explosive. It withstands heat of over 1000° F., and is unaffected by the standard 200-hour salt spray tests, or weather-ometer tests equal to 5 years normal weather.*

CHICAGO VITREOUS ENAMEL PRODUCT CO.

Cicero, Illinois

Preparation of Arc Welded Machinery for Finishing

By WALTER J. BROOKING

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FEW steps in the manufacture of arc welded machinery are deserving of more care and attention than the cleaning operation which prepares the machine for its protective covering of paint, yet it is frequently a step that is hastily and incompletely done. This is particularly true of welded structures on which the welds receive no grinding or special attention prior to finishing.

The preparation of fabricated machinery for its first coat of paint automatically sets the standard of the appearance and controls the life of the machine to the extent that it protects the surfaces from the ravages of corrosion. Usually, if the first protective coating breaks down, successive coatings are short-lived unless the first is completely removed—a process which is usually too expensive or laborious to be considered practical under most conditions.

There are probably many reasons for imperfectly cleaned weldings and it may be that an incomplete understanding of all of the facts involved in such cleaning processes is the primary reason for the breaking down of the protective paint coating on welded structures as illustrated by Figure 1.

This structure was welded and machined and then given a thorough brushing, hand chiselling and, in addition, a washing to remove the oil and other foreign matter which had accumulated during fabrication and machining. This was followed by the application of two coats of paint.

In spite of this apparently complete cleaning process, the paint failed badly within six weeks and the most serious failure occured on and near the welded joints.

The reason for the failure is that the cleaning of an arc welded structure is fundamentally both a physical cleaning and a chemical cleaning process and often one or the other,

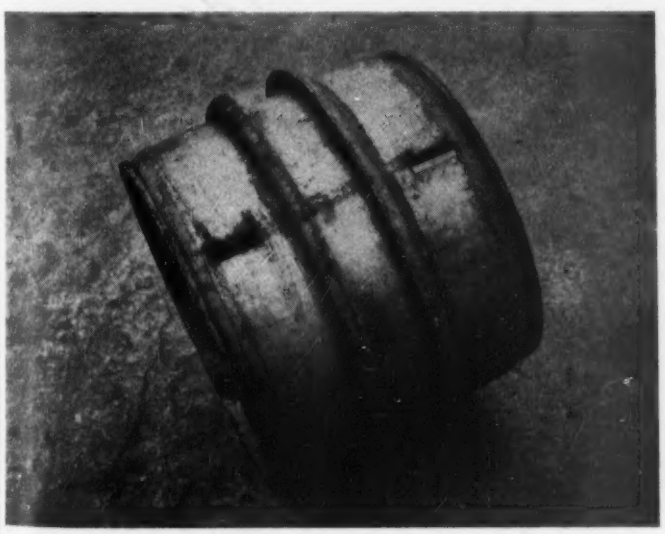

Fig. 1. The dark fringes along the welds on this wheel are rust spots which indicate the breakdown of the paint on and near the welds.

Fig. 2. A thorough physical cleaning will remove the slag, dirt and spatter drops from this structure and prepare it for chemical cleaning.

or both, of the processes is incompletely done. In this case (Figure 1) the structure was not chemically cleaned properly before painting.

The steel from which the structure is made usually has some scale, dust and other foreign matter on it when it is taken from stock and prepared for welding. The cutting, shaping, pressing, machining and handling of the parts before the actual welding process almost always leave them with oil and grease spots on them which often increases the scale and dust accumulation and also often results in some degree of rusting of the parts. To this the welding process adds the rippled surface of the welds, a variable amount of slag which adheres to the weld beads, a quantity of spatter drops (the spray of globules of metal emitted by arc explosions) and a smoky, dusty deposit of chemicals which were vaporized by the arc and condensed on the plates adjacent to the weld. The structure shown in Figure 1 received a passably good physical cleaning but not sufficient chemical cleaning.

Physical Cleaning

A thorough physical cleaning is the first part of the cleaning process. The type of equipment used varies with the size and nature of the structure but the object of the process is to remove from a welded and, in many cases, a machined and assembled structure, the slag, spatter drops, dust, scale and other foreign matter which adhere to the surface and interfere with either the coat of paint or the desired physical appearance of the completed structure.

Figure 2 shows a part of the main body of an all-welded earth moving machine as it appears before the cleaning

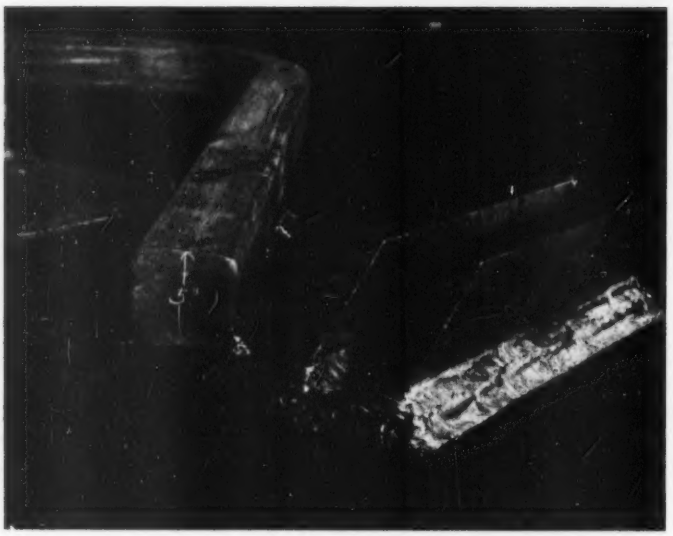

Fig. 3. The same structure as shown in Fig. 2, after the physical cleaning process. Note the many small ripples, weld joints, etc., which may harbor chemical deposits from the welding process.

process starts. It is first brushed clean with a power buffer to remove dirt, scale, spatter-drop globules and slag. In deep corners and tight places where a power buffer cannot reach all of the surface, a stiff wire brush is used. Strong sandblasting or grit-blasting of the whole unit with special attention to the welds is a more satisfactory method of cleaning than buffing since it is faster and does a more thorough job. After the brushing or sandblasting there are fragments of slag which cling to the welds, large spatter drops which have fused with the surface of the welds and sometimes the remains of small tack welds left after tacking small, temporary spacers to the structure prior to welding. These are removed from the structure with a light air chisel, or with a hand slagging tool, leaving the structure as it appears in Figure 3. Its surfaces are as free from irregularities and rust and scale as is necessary for such a piece of machinery and are, therefore, ready for the washing which will prepare it for the first coat of paint.

Structures which are welded, then stress relieved and

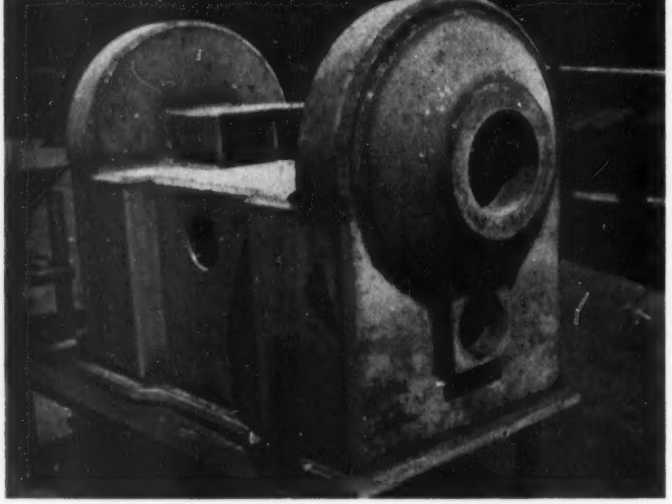

Fig. 4. This transmission case with its complex shape, numercus welds, scale from normalizing and oil from machining operations presents a more complex cleaning problem than a simple welding.

machined, such as the transmission case shown in Figure 4, present a somewhat more complex cleaning problem. A sandblasting or shot blasting prior to machining removes the scale and most of the adhering slag and spatter drops. A hand or power chiselling operation completes the removal of the solid foreign materials which have to be removed before painting. After the structure has been machined, the oil and the accumulated dirt and chips must be washed off as part of the chemical cleaning.

Physical cleaning of small welded parts, either plain or heat treated, usually can be effectively accomplished by hand or power brushing or blasting with shot or sand (whichever method is more easily available or proven by study to be cheaper), followed by chiselling to remove spatter drops and slag fragments.

Chemical Cleaning

Welded structures which are cleaned by brushing or blasting and touched up by chiselling, such as the one shown in Figure 3, still harbor materials which must be removed.

Almost all electrodes leave a deposit of chemicals along the margins of the welds wherever an arc has touched the plates during the welding. In almost every case there are soap-like compounds in the deposit which are strongly alkaline. In some instances these chemicals are present in a large enough quantity and are sufficiently hygroscopic to absorb an appreciable amount of moisture from the air and even form a dark, oily-appearing margin along each side of the weld within from two to twelve hours, especially in very humid, warm weather.

One simple test which shows the alkalinity of the arc fume deposit is to apply a moist paper or finger to the smoke deposit along a weld and then taste it. It almost invariably tastes soapy (alkaline).

Figure 5 shows the result of a more sensitive test for this alkalinity. The weld on the plate is entirely comparable to any weld on the cleaned structure in Figure 3. The slag, dust, arc-smoke and spatter drops were brushed and chiselled off. An ordinary chemical filter paper was then dipped in a solution of distilled water containing a few drops of 1% solution of phenolphthalein in alcohol and then gently pressed down on the surface of the weld and adjoining plate. The dark margin on the filter paper (Figure 5) over and near the weld is the pink coloring caused by the reaction between the phenolphthalein and the alkaline compounds left from the arc. It was these compounds which were not removed from the structure shown in Figure 1 before the paint was applied and it was these compounds which caused the paint covering to break down and rust spots to appear within a short time.

The chemical cleaning must remove the alkaline compounds on welded structures if a lasting paint coating is to be obtained. It may be possible to apply enough coats of paint to cover up these compounds but they are usually sufficiently hygroscopic to draw some moisture from the air, thus giving the paint a tendency to peel easily. The thicker the coat of paint, the easier it seems to peel off if there is moisture or an alkaline residue from welds under it.

A simple washing with water or some solvent which will also dissolve the oil and grease from the structure is usually not sufficient to remove enough of the alkali to insure a lasting paint coat. A wash, or a series of washes, to neutralize the alkali and carry most of it away in solution

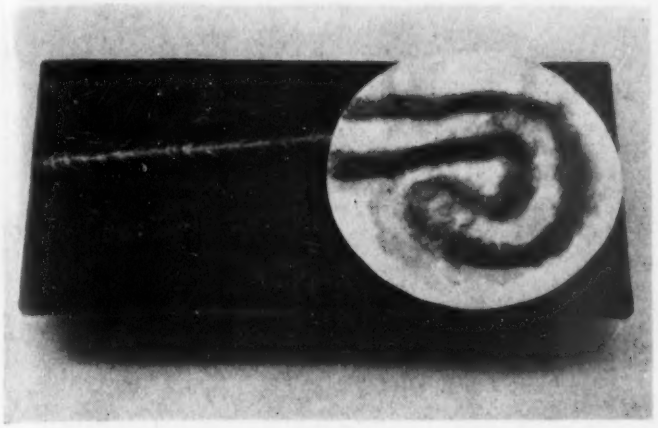

Fig. 5. The dark line on the paper disc is caused by a 1% solution of phenolphthalein turned red by the alkaline chemicals deposited on the plate by the arc. These chemicals cannot be brushed off and will cause premature failure of the paint film unless removed by chemical cleaning.

and one to remove the grease and oil and leave the surface of the metal dry and ready for the paint are required.

Steam cleaning can be employed to remove oil and grease. In the case of products requiring pickling to give the unit a high degree of smoothness, the pickling process removes both the alkali and the grease.

For ordinary welded structures which are not pickled nor especially greasy, there are several chemical cleaners on the market which neutralize the arc smoke deposit and function as satisfactory cleaning agents. The best of these consist of a solvent, such as naphtha, -mineral spirits or oleum spirits, combined with an acid agent which will neutralize the alkali residue. Some are acidified water solutions.

The application of such washing agents may be done in several ways, the one shown in Figure 6 being among the best. Since the function of the wash is that of removing dust, oil and other such residues as well as wetting the whole surface (especially adjacent to the welds) to chemically neutralize and sluice off the alkali, the application of it as a spray has some very significant advantages. Spray applications save much of the labor involved in brushing and also save the cost of brushes, an important item if three or four inch standard painting brushes or other high quality brushes are used. Studies comparing brushing or wiping with cloths to spraying indicate that less cleaning material is usually used in the spraying process.

Another advantage of spraying such cleaning materials is that the workman does not have to get his hands in the cleaning agent, nor does he have to work so close to it that his clothes get wet or soiled.

Fig. 6. One of the best methods of applying cleaning agents is by spraying. This large tractor-mounted all-welded earth moving unit can be thoroughly washed in a few minutes by spraying.

Cleaning Inspection and Control

The control of cleaning processes on welded structures and the exact specification of the degree of cleanliness required to pass inspection present several problems. However, it is quite important that such control be exercised in the interest of economy and uniformity of the finished products. The type of unit shown in Figure 6 represents the large class of welded machines which are cleaned "as welded" after fabrication and assembly.

Probably the most important step in controlling the amount of blasting or buffing is telling the operator how far to go in such a way that he can consistently complete the cleaning job up to a certain standard and no further.

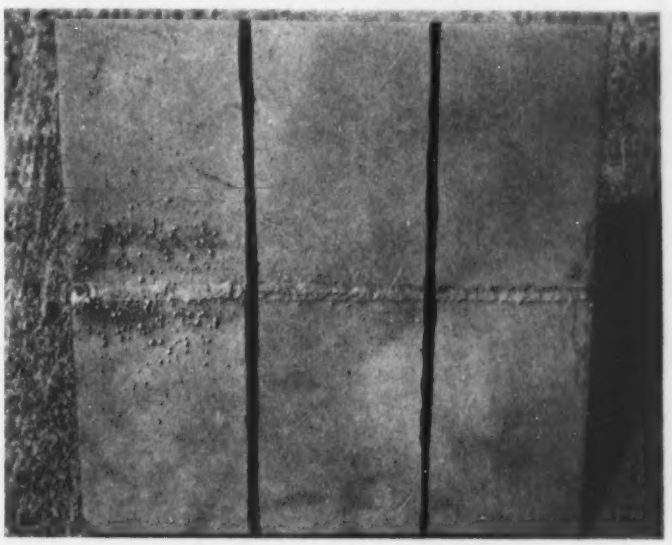

Fig. 7. These standard weld cleaning plates show operators and inspectors (left) an uncleaned weld, (center) a partially cleaned weld which will not pass inspection and (right) an acceptably cleaned weld.

It is almost a universal human trait to overdo a job (such as cleaning) rather than to do less than is required. This arises from the very natural desire on the part of almost everyone to want to do a job that cannot be criticized.

In cleaning welded structures, it seems to produce the best results if the workman is instructed to concentrate on the welds and weld margins, since it is there that slag, spatter drops and most of the other materials which are associated with welding and which are difficult to remove are to be found. On much of the welded machinery such as that shown in Figure 6, if the welds are properly cleaned, there will have been sufficient cleaning done so that the effects of the cleaning (blasting or buffing) process will have spread over and adequately cleaned the surface of the steel parts joined by the welds.

The grinding of welds to make them smooth and free of ripples, as is done on some types of welded structures, re-

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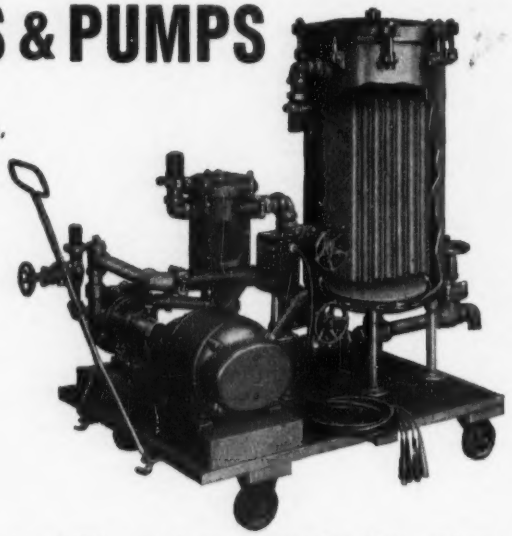

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moves the slag and irregularities from the weld itself but does not always remove the spatter drops from the adjoining areas nor does it eliminate the need for chemically cleaning them.

The problem of just how much brushing or blasting shall be done by the man who does the preliminary cleaning and exactly how complete a job of scraping off the spatter drops and slag flakes shall be done has been helpfully defined by the use of cleaning specimen plates such as the one shown in Figure 7.

The plate (Figure 7) on the left has been welded in such a way as to cause large spatter drops and a wide, flat bead in the as-welded state. The central section shows a partial job of cleaning which will not pass inspection because of the numerous spatter drops remaining on the plate. The section on the right end represents the cleaning job which will pass inspection.

This type of specimen plate is posted in the cleaning department where it can be used by any workman to compare with his job of cleaning and also can be used by the inspection department as a specification for completeness of cleaning. Pictures of the plate are filed in the inspection department as a master specification to assure a uniform standard of cleaning over a period of time. Control of the physical cleaning process is materially assisted by using specimen plates.

The control of the chemical cleaning lies in the thoroughness of the inspection after the final washing is completed. It is not difficult to tell where places have been missed in the washing process and, if the cleaning solution has the required chemical strength, a place that has been thoroughly wet and washed free of grease and dust can be considered clean.

A good inspection of all parts of the unit just prior to the application of the first coat of paint is quite certain to be a profitable investment of time and effort because it not only serves to control the appearance of the finished product by reducing to a predetermined minimum the number of spatter drops, slag chips, etc., left on the surface but it also assures a lasting protection from corrosion and a favorable appearance of the unit by insuring a complete removal of the chemical elements associated with arc welding which cause paint coatings to fail prematurely.

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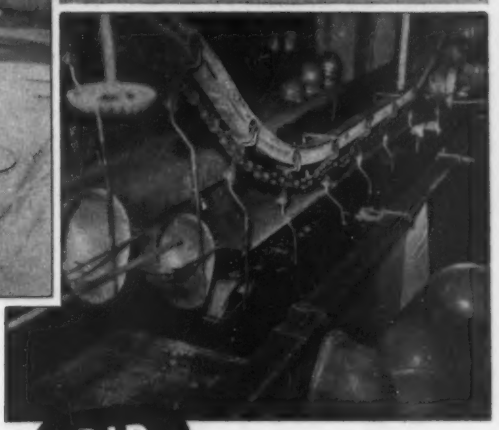

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The Thickness of Paint Films Applied With a Straight Edge Spreader *

THE accurate evaluation of a number of important paint and film properties is dependent on the production of films of uniform thickness which can be duplicated and reproduced easily and with a reasonable degree of accuracy. Brushing and spraying, the most common methods of application, produce films which are of varying and non-uniform thickness and practically impossible of exact duplication. Flowing and dipping are limited to a few paints of the proper thin consistency and yield wedge-shaped films. Among the many mechanical means suggested for the production of uniform paint films[1, 2, 3, 4] doctor blades or scrapers have met with particular favor because spreading by the use of a rigid bar seemed to insure uniform film thickness regardless of the type and nature of the film forming material. The instruments based on this principle vary from the complicated apparatus designed by Brier and Wagner[5] to the simple scraper or spreader[6].

In the use of the doctor blade the tacit assumption was made that the thickness of the wet film obtained is identical with the clearance of the scraper or spreader. A more careful examination of the conditions governing the flow of paint through the clearance in the light of the laws of plastic flow through an orifice of rectangular shape, however, threw considerable doubt on the validity of this assumption. Type and degree of consistency of the paint, rate of travel of the spreader, etc., were expected to affect the nature and especially the thickness of the film deposited. A more exact knowledge of the relationship between the spreader clearance and the thickness of the resultant film seemed to be desirable for the correct interpretation of the results of a number of common paint tests. An investigation was, therefore, undertaken to determine the thicknesses of the films deposited when a series of paints varying over a wide range of consistencies was applied by a number of spreaders of different clearances. This investigation has yielded such interesting and unexpected results that it is reported in some detail in this paper.

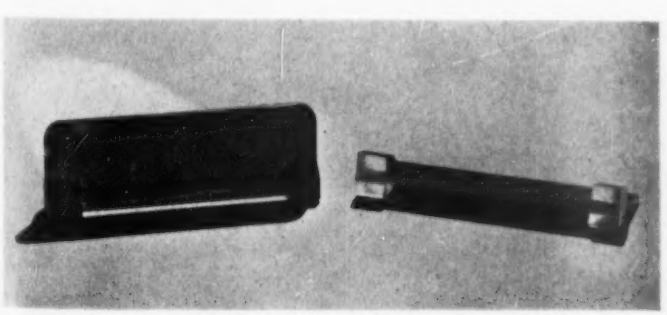

Fig. 1. Paint spreader.

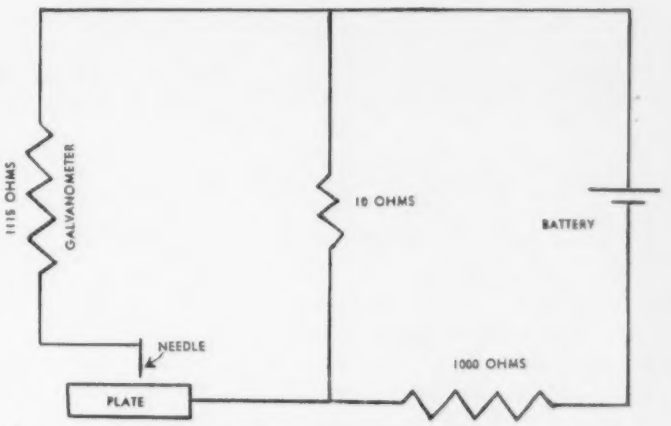

Fig. 2. Schematic wiring diagram for needle micrometer.

Preparation of the Films

Films of paint were applied with a series of two-point contact spreaders accurately machined to definite clearances. (Figure 1)

In order to obtain films of uniform overall thickness it is necessary that the surface to which the paint is applied be not only perfectly flat but also possess sufficient rigidity that the slight pressure applied to the spreader does not cause any depressions to be formed by the spacers. Spreaders, therefore, cannot be used for the application of perfect films to ordinary wood panels, paper, oilcloth, or other similar surfaces, although for certain comparative work, fairly satisfactory films can be produced on these materials. In the actual application of a film, a reasonably sized spot of paint was placed on a plane polished metal surface in front of the spreader, and the spreader, held down with an even pressure, was drawn across the panel. The speed of withdrawal was so regulated to permit the paint to flow out evenly so that a very uniform film was deposited over the entire distance between the spacers.

Measuring the Thickness of the Films

Film thickness may be measured in a number of ways.[7] Stick micrometers frequently used for this purpose are satisfactory for the measurement of the thickness of dry films but are inadequate for wet film measurements, since it is extremely difficult to find the exact setting at which the micrometer stick makes contact with the surface of the wet film and the background over which the paint is applied. Ordinary microscopic methods are applicable to dry films only, whereas the Pfund thickness gauge is limit-

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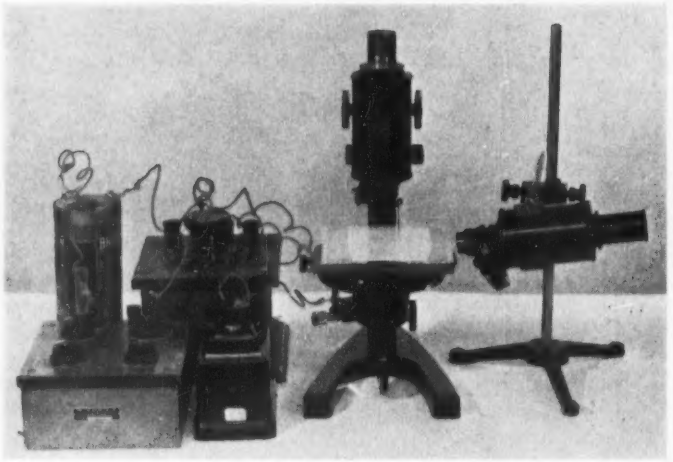

Fig. 3. Needle micrometer for the determination of the thickness of wet or dry paint films.

ed to wet films. To overcome these objections and limitations, a microscopic set-up was designed which is simple to operate and yields very accurate results.

A needle was attached vertically to an objective holder mounted on a microscope, the vertical travel of whose barrel could be measured with an accuracy of one micron (0.0000394 inch). In the accurate determination of the thickness of a wet paint film with this apparatus, two criteria have to be met. The first is to determine when the needle point comes in contact with the film surface, and the second to determine when the needle has just penetrated the entire film. The first objective was met by focusing a horizontal microscope (objective—48 mm., eyepiece—25x) on the needle point as it approached the wet film. Contact was easily determined when the needle point and its reflected image in the film just met and the needle point was wetted by the paint. At this moment the paint can be seen to run up the sides of the needle, which is so characteristic that it can hardly be missed.

The second objective was not so easily met. The first set of experiments comprised the determination of the thickness of paint films spread on plate glass panels. Penetration of the needle through the film was followed by watching a mark on the needle and taking as endpoint the moment at which all downward motion ceased.

This practice dulled the needle point, and proved very unsatisfactory. The next scheme to be tried consisted in determining the moment of contact of the needle point with the underground electrically. A four and one-half inch square brass plate was ground and polished to a plane flat finish. A neon lamp was placed in an electrical circuit which was completed when needle point and brass plate came in contact with each other. However, it was discovered that the neon lamp, although drawing only 0.005 ampere, caused severe wearing of the needle point, resulting in unreliable thickness values.

The final arrangement which gave satisfactory results and did not damage the needle point, consisted of a high resistance galvanometer excited by a dry cell. Closure of the circuit by contact of the needle point with a brass plate resulted in the flow of a current of only 13 microamperes. (Figures 2 and 3) Before the apparatus was used for measurements, the needle point was carefully sharpened to a very fine point and continued usage did not alter or dull it.

Experimental Results

Since it had been assumed that the consistency characteristics of a paint would be the main factor controlling the thickness of the film deposited by a spreader, numerous paints covering a wide range of consistencies and flow characteristics were investigated. Films were spread out with scrapers ranging in clearance from 10 to 112 ten-thousandths of an inch. The films obtained covered a range of thicknesses sufficiently large to include most commercial one-coat applications. The thickness of the film deposited was measured immediately in five or more places before loss of volatile could cause noticeable shrinkage. The error in reproducibility of films spread in this manner was less than two per cent. Although many paints were measured, only a few representative results are shown in Table 1.

These results show clearly that the thickness of the resultant films is much less than the machined clearance of the spreaders. In all cases investigated to date, the thickness of the film deposited is but half that expected from the clearance of this type of spreader. As shown in the last column of Table 1, the ratio between spreader clearance and wet film thickness is very nearly 2:1, regardless of the type of paint. Even great variations in consistency exert little or no influence upon this relationship, as evidenced by a comparison of the values obtained with various flats and enamels. Pigment concentration also is of surprisingly little influence on this ratio as shown by the last three paints in the table. The only appreciable deviation from this 2:1 ratio is shown by the thinnest of the films tested.

Reconsideration of the factors involved in what, to us at least, was the rather surprising observation that the type of spreader used in these experiments tended to lay down a film approximately only one-half that of the machined clearance has suggested the following plausible explanation. Figure 4 represents a cross section of the working part of the 0.006″ paint spreader drawn to scale. When the ratio of clearance to shearing area is thus portrayed, it can be seen that in applying a film with an apparatus of this kind, the paint is essentially being sheared off between two parallel planes and it is logical that the paint be sheared off in the central region of the film, resulting in the deposition on the base plate of a film having a thickness approximating one-half that of the spreader clearance.

In order to test this hypothesis, the shearing surface of one spreader was reduced to a narrow edge (see Figure 5). Paint films applied with this spreader were not one-half the clearance in thickness, as with the previous spreaders, but approximated more closely the full clearance of the spreader.* Since this width of the working edge is not infinitesimal, there is always a certain amount of paint which adheres to the edge and causes the film to be slightly thinner than the machined clearance of the spreader. Tests with this type of edge have also shown the thickness of film applied to be independent of the type and consistency of the paint.

*Such a spreader having a clearance of 0.006″ for instance, deposited wet films ranging in thickness from 0.0053″ to 0.0055″.

TABLE 1

Spreader Clearance and Film Thickness Data

Type of Paint	*Type of Consistency*	*Spreader Clearance in Inch/10,000*	*Thickness of Wet Film in Inch/10,000*	*Ratio Clearance Film Thickness*
Flat Wall Paint A	Thin consistency, low yield value	112	60.0	1.868
		80	40.5	1.976
		60	30.0	2.000
		36	18.7	1.925
		20	9.18	2.180
		10	6.20	1.613
Flat Wall Paint B	Medium consistency, slight yield value	112	57.8	1.938
		80	40.5	1.976
		60	30.5	1.967
		36	19.5	1.846
		20	9.02	2.219
		10	6.70	1.493
Flat Wall Paint C	Medium consistency, high yield value, buttery	112	59.6	1.880
		80	41.5	1.928
		60	32.3	1.857
		36	20.5	1.757
		20	9.51	2.103
		10	6.66	1.503
Flat Wall Paint D	Heavy consistency, slight yield value	112	56.6	1.979
		80	39.2	2.032
		60	30.1	1.993
		36	19.2	1.875
		20	9.84	2.033
		10	6.75	1.483
Quick Drying Enamel E	Heavy consistency, low yield value	112	56.3	1.990
		80	39.0	2.052
		60	29.5	2.034
		36	19.2	1.875
		20	8.87	2.258
		10	6.61	1.513
Mill Gloss Paint F	Heavy consistency, slight yield value 63 per cent pigment	112	56.8	1.973
		80	39.9	2.007
		60	29.6	2.028
		36	19.7	1.828
		20	9.90	2.022
		10	6.55	1.527
Mill Gloss Paint G	Medium consistency, slight yield value 55 per cent pigment	112	56.3	1.990
		80	39.7	2.015
		60	29.2	2.055
		36	19.8	1.818
		20	9.82	2.038
		10	6.66	1.503
Mill Gloss Paint H	Thin consistency, low yield value 45 per cent pigment	112	56.8	1.973
		80	39.8	2.012
		60	29.2	2.055
		36	19.3	1.856
		20	9.45	2.118
		10	6.77	1.477

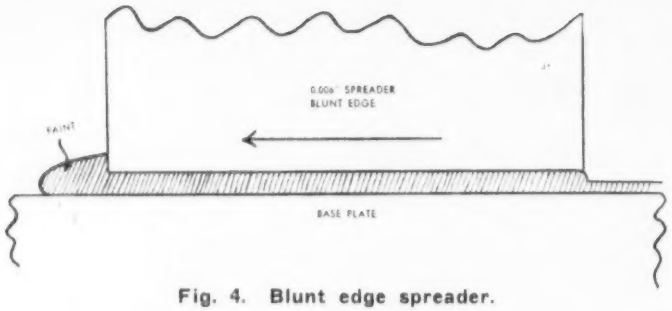

Fig. 4. Blunt edge spreader.

The surprising thing is that the blunt edge spreader (Fig. 1 and 4) seems to so closely approach the condition of a film being sheared between two infinite planes. Although it is doubtful that a complete formal solution of this problem could be worked out on this basis ignoring end effects, it would appear that the influence of the end effects is surprisingly small.

Although the knife edge scraper may offer certain advantages because it deposits films of a thickness almost as great as the machined clearance, its susceptibility to damage by nicking will make it inferior to the other type of spreader as a tool for ordinary testing work. The reproducibility of any film thickness by means of either spreader is very good, as indicated by a comparison of the various films spread with the same spreaders. However, it appears that if it is desired to know the exact thickness of the film deposited by any spreader, it should be calibrated in some way rather than relying upon the machined dimensions. Once the actual film thickness obtained with any spreader is accurately determined by some means such as the needle micrometer, that thickness can be consistently reproduced to within one or two per cent. Thus it seems that the preparation of films by means of calibrated spreaders furnishes

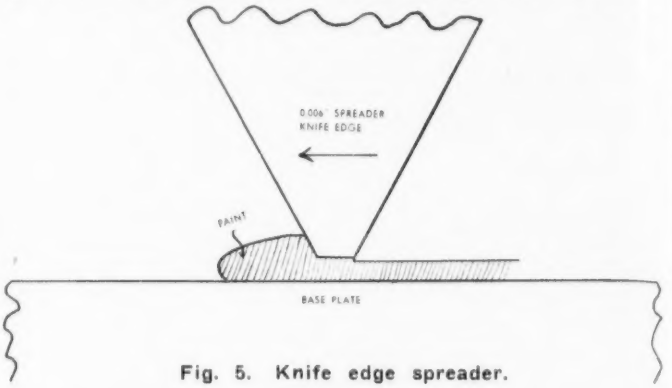

Fig. 5. Knife edge spreader.

a relatively simple means of obtaining uniform films of known thickness with a degree of accuracy and reproducibility comparable with some of the more elaborate schemes that have been proposed.

[1]*Gardner, H. A., Phys. & Chem. Examination, etc., 8th Edition, 253.*
[2]*Arlt, H. G., Steel,* **98**, *42, 44, June 15, 1936.*
[3]*Haslam, G. S., J. Ind. Eng. Chem., Anal. Ed.* **2**, *319, 1930.*
[4]*Bruins, P. F., J. Ind. Eng. Chem., Anal. Edition* **9**, *376, 1937.*
[5]*Brier, J. C. and Wagner, A. M., J. Ind. Eng. Chem.* **20**, *759, 1928.*
[6]*Gardner, H. A., Phys. & Chem. Examination, etc., 8th Edition, 256.*
[7]*Gardner, H. A., Phys. & Chem. Examination, etc., 8th Edition, 264.*

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Storage and Protection of Flammable Liquids

By H. E. NEWELL

Assistant Chief Engineer, National Board of Fire Underwriters, New York, N. Y.

AN outstanding factor in the progress of modern industry is the use of flammable liquids. In fact, a substantial proportion of industry is built around and depends for its operation upon the use of these liquids. Inherently hazardous, but possessing properties the value of which offset the elements of danger, these liquids in the form of solvents such as the acetates, alcohols, benzol, toluol, and, of course, the petroleum products such as gasoline, kerosene, etc., contribute mightily to industry's march of progress. The liquids named are but a very small percentage of a wide and steadily increasing number of solvents and fuels.

It has always been necessary to exercise care in the storage and handling of these liquids in order to prevent their inherent hazards from becoming active. This need becomes imperative in times such as these. The inherent dangers of flammable liquids are fire and explosion, and such occurrences in a large airplane plant or in any other plant devoted to the production of munitions slow up the country's war effort. For this reason we may to advantage give some thought and consideration to those factors which influence and determine the character of safeguards required for the safe storage and handling of these liquids. Obviously, their chemical properties enter into this consideration: hence, a description or explanation of these properties is in order.

Chemical Properties

Flashpoint. By this term is meant the temperature at which any liquid gives off vapor in sufficient quantities to form combustible mixtures with air. While other properties are factors in determining the hazard of a liquid, the flashpoint is the principal measure. It should be borne in mind that the hazard increases as the flashpoint lowers or decreases. The significance of this property becomes more apparent when we compare liquids of different flashpoint. Kerosene has a flashpoint of approximately 100° F., closed cup tester; hence, at ordinary temperature, i.e., 70° F., it is not giving off dangerous quantities of vapor. On the other hand, gasoline gives off vapors at a rate sufficient to form combustible mixtures with air at or below 0° F.

Ignition Temperature. This term means the temperature at which a combustible mixture of vapor and air will ignite solely by heat and without the presence of a flame or spark. This is sometimes termed the temperature of autogenous or automatic ignition. For instance, the ignition temperature of varying grades of commercial gasoline ranges from 500° F. to 600° F., while that of kerosene varies from 480 to 490° F. This property is highly important to know in any given case because it bears so heavily on safe processing.

Explosive Range. We frequently hear the engineer dealing with gases and vapors refer to the "explosive range" of some certain gas. It refers to the range of percentages of air and vapor or gas which are combustible; to illustrate, the explosive range or limits of gasoline is from 1.4 to 6; this means that a mixture composed of 1.4 per cent gasoline vapor and 98.6 per cent air is explosive as are also all the intermediate mixtures up to and including six per cent gasoline vapor and 94 per cent air. This is a material contributing factor to the final conclusion when determining the hazard of any given liquid. Gasoline has a fairly narrow explosive range and this to some extent offsets the adverse factor formed by its extremely low flashpoint. The narrow range of gasoline is emphasized when we compare it with such gases as hydrogen, acetylene and ethylene. These in the order given are 4.1 to 75, 2.6 to 82, and 3.0 to 29.

When considering these properties, it should be borne in mind that what really concerns us is the gas or vapor given off. It is the vapor or gas which burns and not the liquid. The significance of this statement will be better understood if a comparison is made of the properties, flashpoint and explosive range. For this purpose let us consider the flashpoint of gasoline and the explosive range of hydrogen. As earlier stated, gasoline has a flashpoint at or below zero, but after the vapor has been generated, it must be compared as to hazard with some other material which also is a gas or vapor. If then we compare gasoline vapor with hydrogen, we will find that the latter has an explosive range approximately 14 times greater than gasoline. This in plain English means that the hydrogen will be hazardous under a greatly wider range of conditions.

Rate of Diffusion. This, as the term implies, relates to the diffusibility of a gas or vapor. To some extent this depends upon the density of the gas as compared with air and its rate of expansion under varying temperature conditions. Unfortunately, there is less information concerning this property of gases and vapors available than practically any other property data. This is a serious handicap in designing ventilating systems and also systems for automatic control of processes.

We might also consider the weight or density of a gas or vapor. For this purpose it is usual to compare any given gas or vapor with air, giving the air a value of 1. In this way by consulting tables we find that a gas or vapor is lighter or heavier than air. This, too, is important, as it is a material factor in the designing of a ventilating system.

The foregoing properties are factors in determining safe storage but more directly affect handling and processes. The containers are almost always constructed in accordance with the requirements of the Interstate Commerce

(Presented at the 31st National Safety Congress, Chicago, and printed by permission of the author and the National Safety Council.)

Commission and their storage in drums so constructed is usually in an outside or inside storage and mixing room of which more will be said later.

Storage

In general we may consider storage under the following headings: Outside underground, under the building, aboveground, diked storage, and inside the building. Each type of storage introduces a different degree of hazard; the outside underground storage is the safest installation possible, and the inside the building storage the most hazardous.

So far as bulk storage is concerned, i.e., underground and aboveground storage tanks, such necessary details as location and construction of tanks, venting facilities, fill pipes, dikes, etc., are completely covered by the standards of the National Board of Fire Underwriters for the Installation of Containers for Storing and Handling Flammable Liquids. These standards are complete in themselves and inasmuch as they are available upon request, no good purpose would be served by reciting them here.

What appears to be of most importance during the present emergency is the drum storage of flammable liquids inside and outside of buildings and the quantities which may be safely stored under various conditions. Two storage problems are involved, namely, the amount of storage that may within reason be permitted in the room or department where the liquids are used, and in the main storage.

It is usual to permit in the process rooms at least a day's supply, any greater quantity depending upon the judgment of the inspection department having jurisdiction after a consideration of the determining factors later described.

An important factor affecting the extent of the main storage is in the location of the plant. If it is remote from railroads or water transportation and drums must be trucked a considerable distance, much larger main storage will be required than when the plant is close to rail, water or other means for receiving frequent shipments. It is important, however, that the main storage of flammable liquids be separated from the processes of other departments. The main storage should preferably be in a separate building provided for that purpose, but if under the same roof with other portions of the plant, it should be cut off therefrom in a standard manner.

When determining allowable storage requirements due consideration should also be given to floor loads and arrangement of storage. Inside main storage locations should also take into consideration the possibility of flammable liquids or vapors reaching lower floors or basements through unprotected openings where there may be sources of ignition.

Flammable liquids are safe so long as they are confined in a closed container. Their inherent hazard comes into play when in open containers or when leaks or spills occur; then the degree of danger is largely determined by the flashpoint of the liquid, and the range of air mixtures within which their vapors are flammable and explosive.

The rupture of containers may be brought about by mechanical injury resulting from falling walls under fire conditions, rough handling, impact due to falling, the result of insecure tiering or other careless and improper storage methods, deterioration of the container from corrosion and subsequent failure, and excessive interior pressures brought about by high temperatures.

Obviously, if the storage building is of frame construction and more than one story in height, such inside storage cannot be viewed as favorably as in a building of joisted, mill or fireproof construction. Conditions resulting from exposure or nature of occupancy may be such as to render unsafe any storage over and above what may be needed for immediate needs. In other words it may not be wise to permit within certain buildings even a day's supply of flammable liquids. Therefore, such interior storage and handling may be increased in proportion to the degree of improved construction. This conclusion should be somewhat modified by the general policy of, so far as practicable, limiting such inside storage to one day's supply, regardless of construction. This should not be construed as a hard and fast rule, but merely as an assumption when considering any individual case. Furthermore, drums should not be stored outside on building platforms or between buildings, or in locations adjacent thereto, so that in case of fire they may cause it to spread from build. to building.

Fire Protection

Bound up in the consideration of construction is that of fire prevention and protection. Consideration of any given case will include the various possible sources of ignition. Under no conditions should these materials be stored so that flammable vapors from open, leaking or ruptured containers will come in contact with open flames, open fires or sparks from such sources as furnaces, hot water heaters, gas stoves, electric or gas cutting or welding operations.

Without protection, and especially means for the automatic extinguishment of such fires in their incipiency, extensive fires may be possible and probable, even though the construction of the building be strictly fireproof. For this reason a system of automatic sprinkler or other approved means for automatically extinguishing a fire in its incipiency should be a cardinal requirement wherever any material, drum or other sealed container, storage or handling is maintained or carried on.

The containers themselves require careful consideration. If they are used in interstate commerce, they will be constructed in accordance with the rules of the Interstate Commerce Commission; these rules assure rugged and safe construction. On the other hand, if they are not intended for interstate commerce their manufacturers and users are not bound by any federal regulations and there may not be any state or local rules, and they may consequently be of light, flimsy construction and therefore subject to rupture upon forcible impact. Further, they may have soldered joints with solder of low melting point and thus be liable to fall or rupture when subjected to relatively low temperatures.

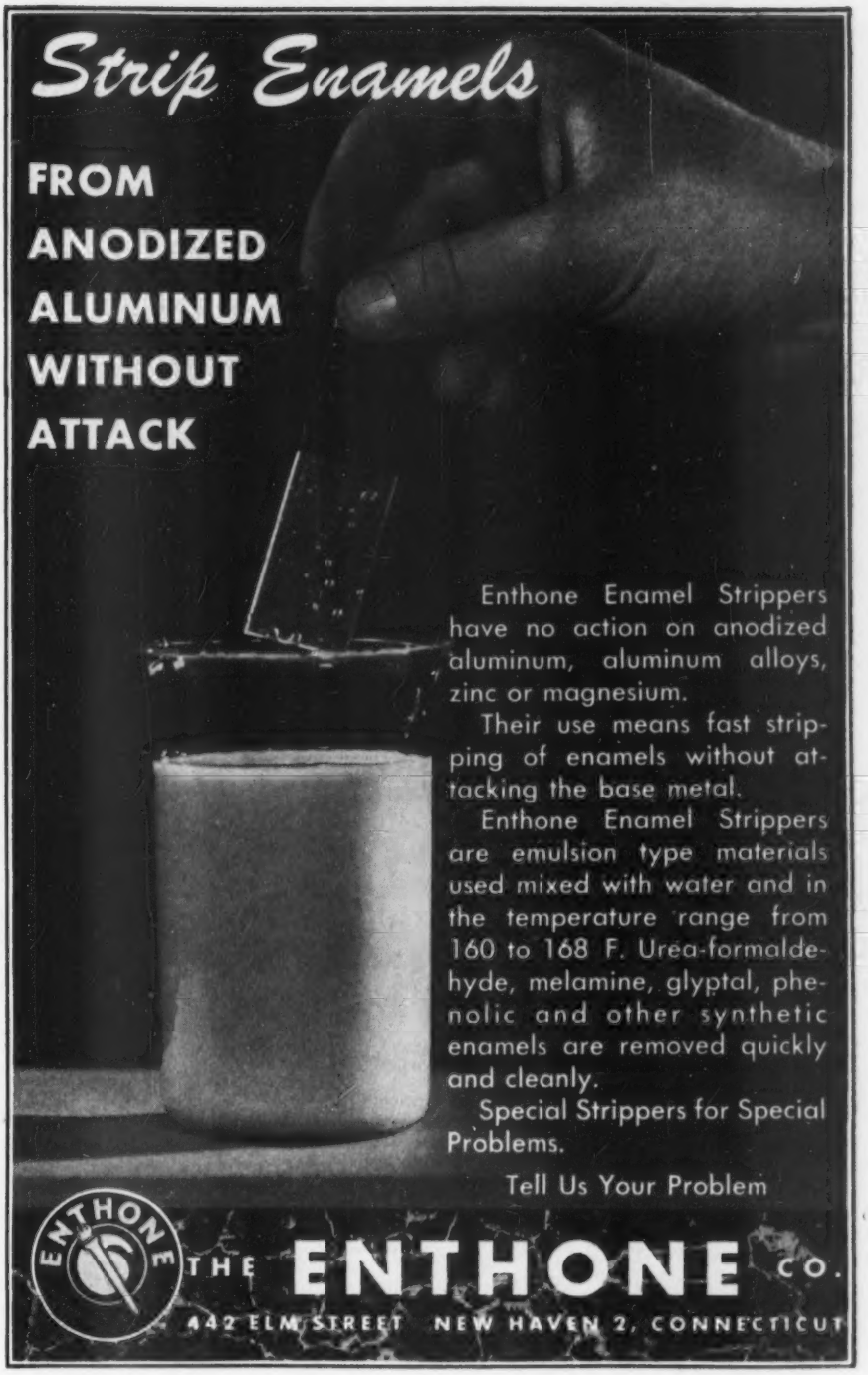
Involved in container construction is the feature of size. Obviously, an I.C.C. drum of 55 gallons capacity does not create any material apprehension regardless of the condition of storage, but a 55-gallon drum of light gauge tin or other metal and with soldered joints is another matter. Aside from construction, the size or capacity to a considerable extent determines the potential hazard. The contents of a 55-gallon I.C.C. drum will spread farther than will the con-

tents of a 20-gallon I.C.C. drum. Paints, lacquers, solvents and similar flammable liquids in quart, gallon and five gallon original sealed containers cannot be considered as introducing any great hazard and may be safely stored with or close to other materials and processes in moderate amounts, except where subject to heat. The smaller the container, the safer the storage, although as previously implied, this conclusion must be tempered by the character of the container's construction.

Handling Fluid Contents

The method employed in discharging the contents of drums or other containers is important. The inherent hazards of a flammable liquid or compounds containing such liquid become active when they are exposed. For this reason any method of discharge such as from faucets into open containers or any other method exposing the liquid is open to serious criticism and should be discouraged. The safest method is through the use of a pump employing securely attached and continuous piping or hose lines. Where appreciable quantities of flammable liquids are transferred by pumping or pouring, it is important that the main supply container and container into which the liquid is discharged be positively electrically bonded together and effectively grounded. Where portable transfer of flammable liquids is necessary, it should preferably be by means of approved portable wheeled buggies.

Pamphlet No. 30 of the National Board of Fire Underwriters prescribes detailed specifications for the construction and protection of storage and mixing rooms. These standards so far as construction is concerned, are based on the premise that the type or degree of fire resistiveness of construction for any given case should depend upon the quantity of storage involved as well as the construction of the building in which the storage room is to be located and the extent of mixing operations. For large or unlimited storage, an outside separate storage and mixing room is advocated. In these standards, three specifications are provided, namely, outside storage houses; Type A, Inside Storage or Mixing Rooms; and Type B, Inside Storage or Mixing Rooms. The standards cover construction, lighting, heating, ventilation and protection.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Such rooms should be so located that in the event of fire or explosion the force may be vented in the direction of least exposure and the extent of plant involvement minimized. For this reason, location in a corner of the building where venting in the form of glazed window area in outer walls or the roof is advocated; location in basements should be avoided. Automatic sprinkler protection is essential. If these precautions are taken and supplemented by adequate ventilation, an explosion-proof type of electrical installation, and proper floor drainage facilities, a reasonable and acceptable degree of safety will be assured.

Hoisting and Hanging

The word "derrick" originally meant a gallows. It was taken from the name of the official hangman during the time of King James I.

Technically speaking, a derrick does not move objects in a horizontal plane; it only raises and lowers them. The machine which moves objects both vertically and horizontally is a derrick crane.

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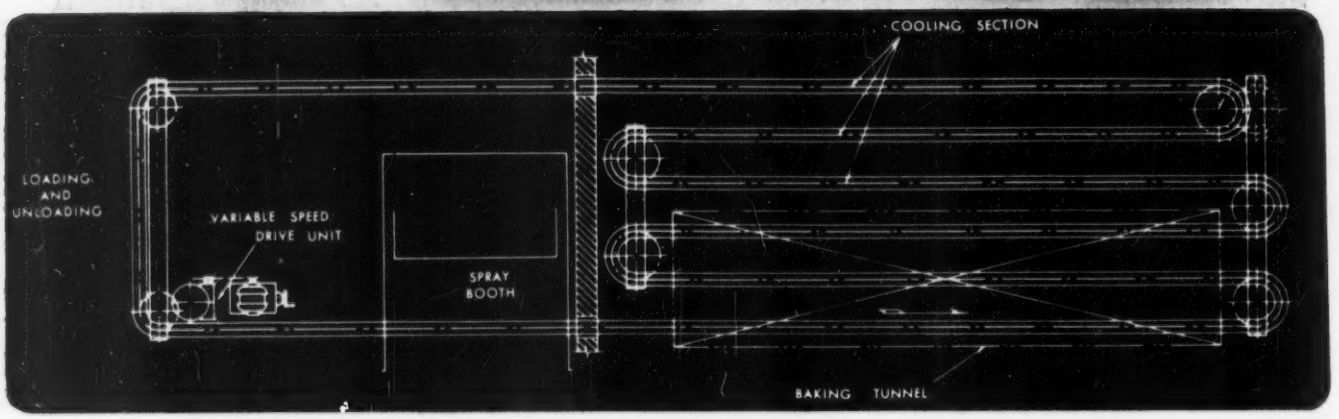

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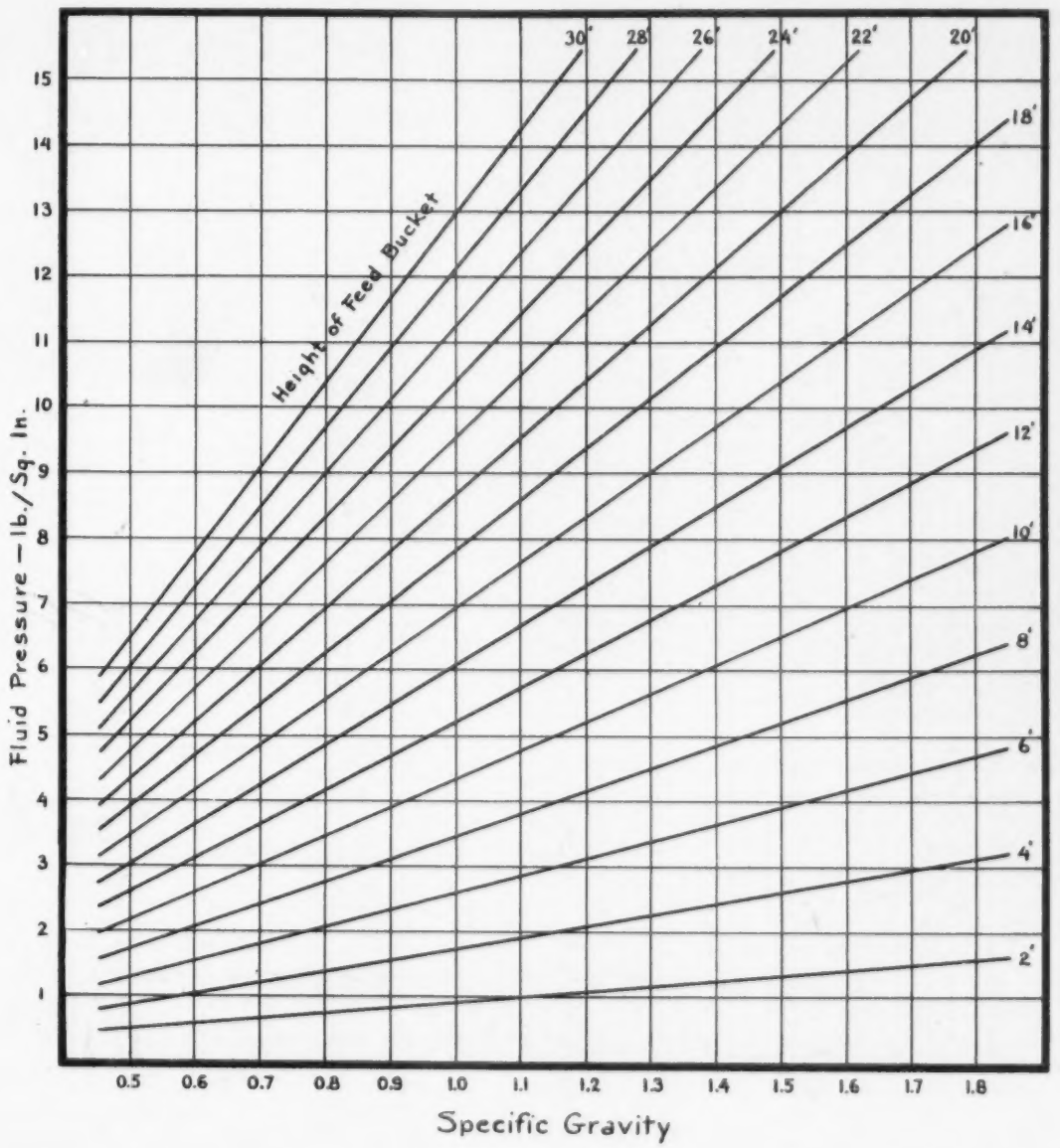
Spray Gun Fluid Pressure Conversion Chart

THE following fluid pressure to gravity bucket height conversion chart will be found useful in determining the height to which a gravity material feed bucket must be raised to approximate a given fluid pressure.

To make the conversion using the chart, a horizontal line is drawn from the fluid pressure scale at the pressure it is desired to approximate. A vertical line is drawn from the specific gravity scale at the value of the specific gravity of the material to be sprayed. The intersection of these two lines will fall on or near one of the sloping lines which give the approximate height (from the surface of the material in the bucket to the spray gun nozzle).

For example, to approximate a fluid pressure of 5 pounds per square inch with a finishing material having a specific gravity of 0.82, it is necessary to raise the bucket to a height of approximately 14 feet.



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Business Items

Roxalin Flexible Finishes, Inc., Elizabeth, N. J. has announced the appointment of *J. F. Burrowes* as manager of technical service.

Mr. Burrowes has been associated with Roxalin Flexible Finishes, Inc. since 1937. After a period spent in the research, manufacturing and control divisions of the company, he was appointed technical representative in the New England territory and served four years in this capacity. Since 1941 Mr. Burrowes has been assistant manager of technical service.

J. F. Burrowes

Recent announcement tells of the resignation of two key executives from the *Chicago Vitreous Enamel Product Co.*, Cicero, Ill. The men are Messrs. *R. L. Foraker*, who was director of engineering and field service, and *H. D. (Dana) Chase*, general sales manager and manager of the Armor-Vit Division. These men have been in the service of the company 16 and 14 years respectively. The reason assigned was an unexpected change in company management.

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Samuel H. Graves has been with *Zapon Division, Atlas Powder Co.*, Stamford, Conn., for the past 51 years.

He began work as a general office man in the New York office of the company in 1892. He later became secretary-treasurer of the Celluloid Zapon Company which position he held until 1904 when the company moved to Stamford. At that time Mr. Graves became superintendent of lacquer operations.

In 1927 and again in 1928 he was sent abroad to lay out the Zapon lacquer plant in France.

Lowell E. White, formerly test pilot for *Wright Aeronautical Corp.*, has joined the research engineering staff of the *C-O-Two Fire Equipment Co.*, Newark, N. J.

Mr. White, who is a member of the Veteran Pilots' Assn., the Quiet Birdmen and the National Aeronautical Assn., has been actively engaged in the flying industry for more than 17 years. He began his career with a solo flight at Richards Field, Kansas City, Mo. Following a period of barnstorming, he obtained a transport pilot's license and returned to Richards Field to become chief pilot and operations manager for Commercial Airways at that field. Later, he held the same post with White Mountain Airlines, Boston, Mass., and still later was chief pilot and operations manager for Curtiss Wright Flying Service, Caldwell, N. J.

Before his association with Wright Aeronautical Corp., Mr. White was for ten years president and general manager of the White Flying Service Corp. at Caldwell Wright Airport where his firm completed the training of more than 5,000 student fliers and 500 civilian pilots under the government's Civil Pilot Training Program. This work, according to Mr. White, involved flying to the extent of some 45,000 hours and 4,500,000 miles, all of which, he says, was accomplished without injury to students or personnel.

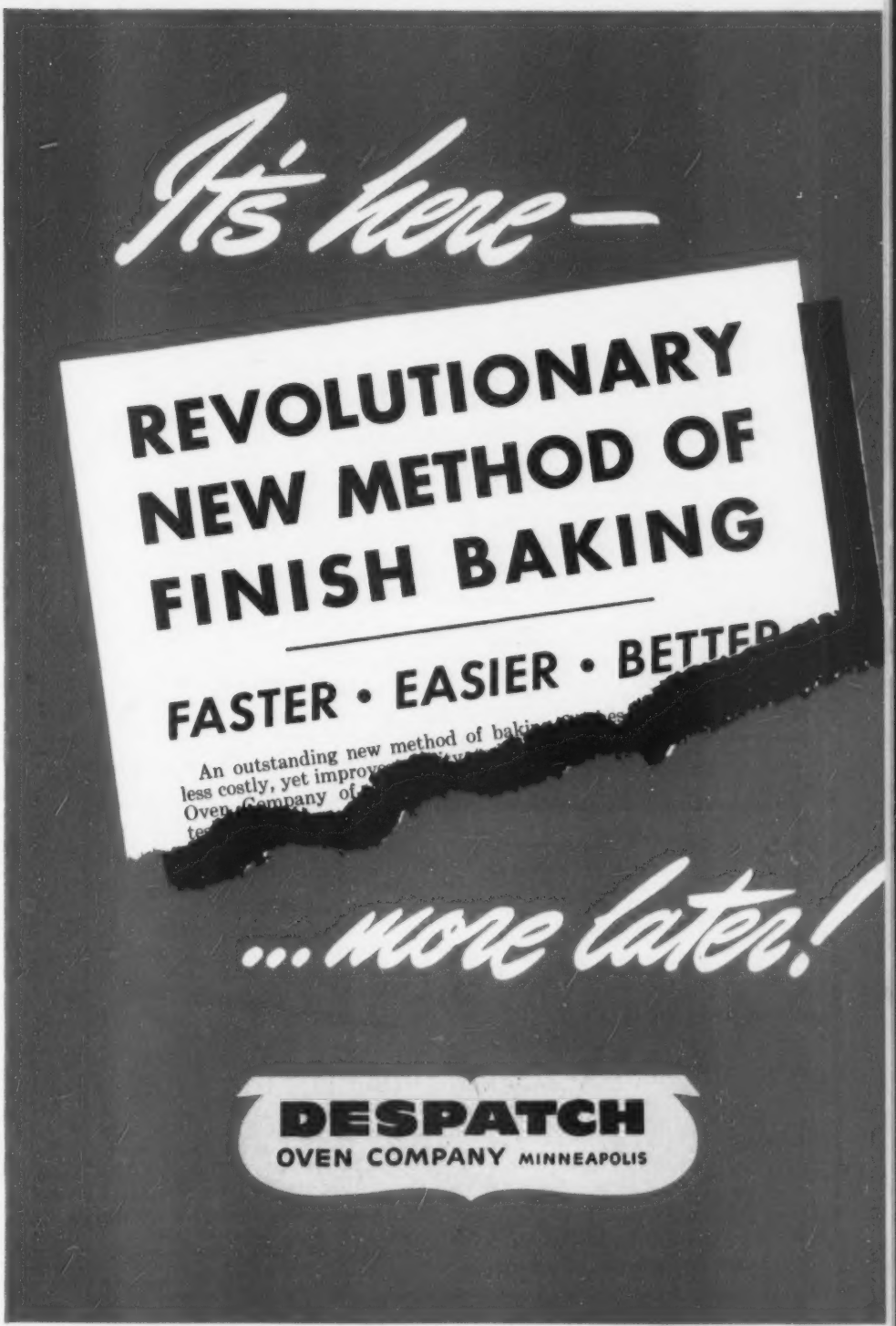
To date, Mr. White has flown in excess of 5,500 hours in about 200 different types of planes.

Interchemical Corp. and the administrative offices of several operating divisions and subsidiaries have moved to the 16th floor of the Empire State Building. Approximately 30,000 square feet have been leased.

The company and its operating divisions and subsidiaries manufacture chemical coatings for protection, decoration and utility; printing, gravure and lithographic inks; industrial finishes, paints, lacquers, enamels, textile colors and allied products.

For the past 13 years the offices were located at 75 Varick St., where they were established in order to have certain technical facilities at the same location. Expansion of the facilities of the corporation has transferred these facilities elsewhere so that it is no longer necessary for the administrative offices to be located in the same building as the manufacturing and service departments.

The new location, which will house the administrative offices of Interchemical Corp., International Printing Ink Division, In-Tag Division, Ault & Wiborg Corp. and the Export Division, has a number of advantages for the tenant. It will be more convenient for many of their customers and the means of transportation used by a majority of their employees are more readily accessible. It is also closer to their main research laboratories in New York and to many of the factories and branch offices of the operating divisions and subsidiaries located in the metropolitan area.



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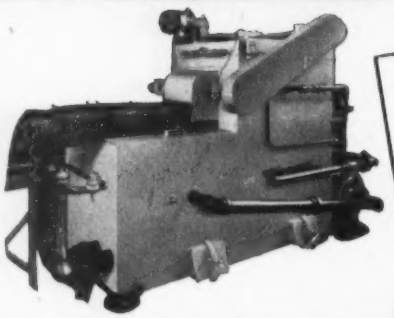

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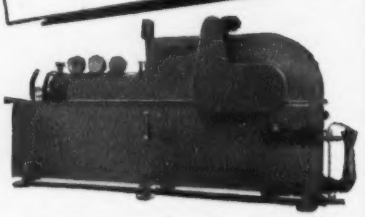

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Conservation of Pressure Sensitive Adhesive Tapes

The Operating Committee on Aircraft Materials Conservation of the Aircraft Production Board, W.P.B., has issued Conservation Bulletin No. 7 dealing with conservation in the use of pressure sensitive adhesive tapes, including masking tape, cellulose tape, etc.

The bulletin states: "Approximately four million pounds of high grade reclaimed rubber and a smaller quantity of crude rubber are being consumed per year in the manufacture of pressure sensitive adhesive tapes. It is estimated that over half of this is used in aircraft manufacture and maintenance and that an important part of this consumption represents waste through careless and extravagant use. As the stockpiles of crude and high grade reclaimed rubber are strictly limited, it is most necessary that unessential uses be discontinued.

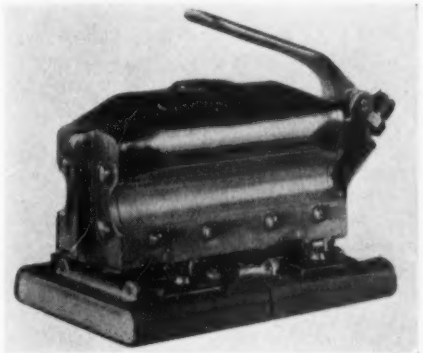
"This bulletin is issued to emphasize this situation to the aircraft industry and to urge that immediate and effective steps be taken to reduce waste in the use of pressure sensitive tape. Each small saving will contribute to an appreciable cumulative total of crude and reclaimed rubber saved. If the necessary conservation in industrial tapes is not achieved through voluntary action, the issuance of an order prohibiting non-essential uses will be unavoidable.

"Several types of industrial tapes are essential to the aircraft industry and are processed for definite and necessary applications, such as protection of metal surfaces, sealing of slots and apertures against dirt and moisture, masking for finishing aircraft and plating metals, photographic uses, the sealing of cartons for overseas shipment and for various other purposes. Certain other present applications, such as most office uses, are non-essential and must be eliminated or tapes using less critical adhesive materials must be substituted. Where the use of pressure sensitive tape is essential, strict economy must be observed and the following economy practices are suggested.

"Tapes having no crude rubber content should be used in all applications except where tape containing crude rubber has been demonstrated to be absolutely essential. In all applications, preference should be given to light weight tapes which require smaller quantities of adhesive per unit area. Tape should be used in the narrowest widths possible. Instead of using wide tape to cover large areas, narrow tape and treated adhesiveless paper should be used. Dispensers (called apron tapers) carrying paper of different widths and a roll of masking tape which covers one edge of the paper and leaves a portion of the adhesive side of the tape exposed for adhering the assembly to the work, should be used whenever possible.

"It is also urged that personnel using pressure sensitive tapes be instructed as to how to effect the greatest possible economy in their use."

New Equipment



High Speed Hand Sander

Designed and built for all practical hand sanding and finishing operations, the Sundstrand sander, manufactured by Sundstrand Machine Tool Co., Dept. OF, Rockford, Ill., is now available in a light weight and high speed model known as No. 1000.

This machine weighs less than six pounds, has a speed of 3500 oscillations per minute and can be equipped with different types of sandpaper attachments for large or small, wide or narrow, flat or curved abraiding surfaces on metal, wood, plastic or composition. Operation of the machine is by means of a palm lever fitted at the top of the machine housing. No switch is required. When the machine is gripped to operate it, the reciprocating action of the pads begins. Upon release, the machine automatically stops.

The sander is said to be free from vibration, thus reducing fatigue and increasing the efficiency of the operator. It is also stated that opposed pad action and balanced moving parts improve the quality of the finished product and that the high speed and uniformity of the stroke materially increase the life of abrasive paper by keeping its surface free from material particles.

IF *YOUR* pickling operation is not as efficient as you believe it should be, why not follow the lead of other famous companies and let us help you?

Shown above is one of the many complete pickling, rinsing, cuprodining, neutralizing, soap-coating and drying machines we have designed, engineered and built for handling 50 calibre steel cartridge cases after the drawing operation. This rotary drum type machine is completely automatic, even to temperature controls. Speedy, it handles 6000 lb. of material an hour.

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New Spray Gun

To overcome the difficulty in securing aluminum and other war time materials, which have been holding up the production of the Thor #7 and #2 spray gun models, the Binks Manufacturing Co., Dept. OF, 3114-40 Carroll Ave., Chicago 12, Ill., are now producing the new Thor #17 Gun.

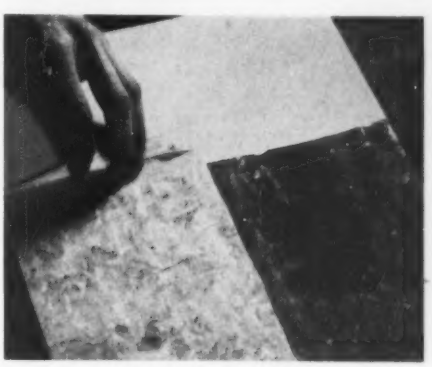
This new model, while not possessing the elaborate finish of the Thor #7, is said to give equal performance, and to be a thoroughly dependable substitute for either the Thor #7 or Thor #2.

Metal Treatment

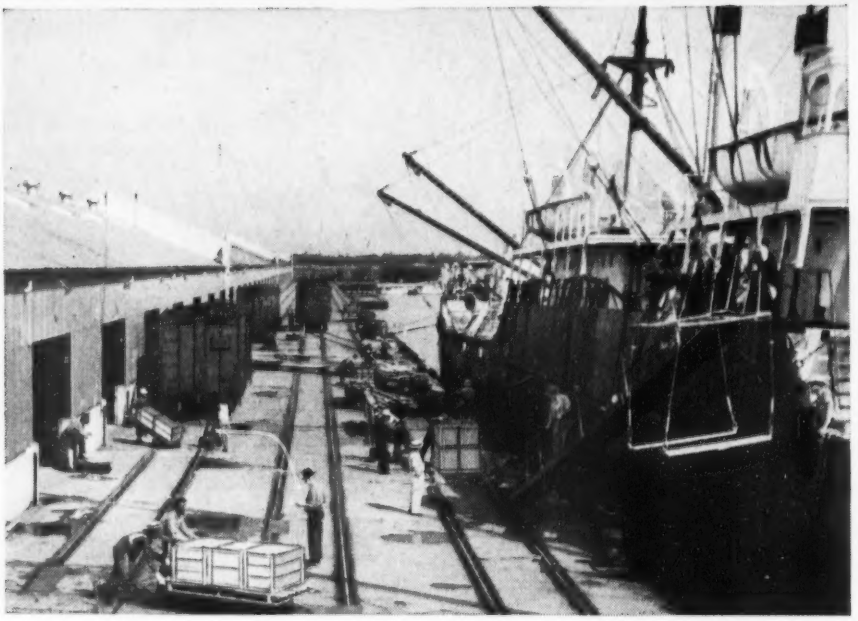
Permanent paint adhesion to galvanized metal, with no chipping or peeling, is insured by preparing the surface with Redi-Paint, according to the manufacturer, Turco Products, Inc., Dept. OF, 6135 S. Central Ave., Los Angeles, Calif. Redi-Paint is said to act on galvanized metal to passivate it and roughen the surface so that paint will hold and remain in good condition.

A unique feature of this material is said to be that it develops a dark tint on areas properly treated, leaving untreated areas conspicuously bright.

Redi-Paint can be applied by hand or by tank immersion.



Paint peels and chips from galvanized metal which has not been properly prepared. Right-hand section shows Turco Redi-Paint and paint adhering to area treated.



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Marschke Swing Frame and Pedestal Buffers are made in sizes from 1 to 15 HP, single and selective speeds. Write for Buffer Bulletin #47.

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Manufacturers' Literature

Fire Protection

The C-O-Two Fire Equipment Co., Dept. OF, U. S. Highway No. 1, Newark, N. J., has issued a new booklet describing its line of portable and built-in carbon dioxide fire extinguishing equipment and smoke detecting systems.

The booklet, printed in two colors and illustrated, describes the application and operation of various kinds of C-O-Two equipment such as hand extinguishers with the newly developed "Squeez-Grip" valve, hose rack, hose reel and wheeled units, and manual and automatic built-in extinguishing systems used for industrial, electrical and marine protection. Smoke detecting systems and recharging equipment are also included.

Copies of the booklet are available on request.

Oven Bulletin

A 16-page bulletin, *Ovens for Industry*, has been issued by *The Lanly Co.*, Dept. OF, 750 Prospect Ave., Cleveland, O.

The bulletin is profusely illustrated with pictures of paint drying and baking ovens, heat treating and conditioning equipment and core and mold ovens manufactured by the company. It contains details of methods of heat circulation, construction, the company's gas fired air heater, etc. Features of the various units are said to include trouble-free operation, rapid and thorough heating of all parts of the load, less time per heating cycle and more cycles per day.

Copies of the bulletin and, if desired, a special bulletin on core ovens may be had on request to the company at the above address.

Furnace Bulletin

A new four-page bulletin, No. 83, describing and illustrating Despatch CF gas and electric furnaces for use in production, research and control has been issued by *Despatch Oven Co.*, Dept. OF, Minneapolis, Minn. Many facts on the construction, performance, heating principles and uses of the furnaces are given and features such as non-warping doors, patented motor shaft cooler, balanced fan, etc., are described. A section of the bulletin is devoted to specifications of the various models which range in size from 13 in. x 13 in. x 13 in. to 37 in. x 25 in. x 37 in. in inside dimensions and up to 1250°F. maximum temperature.

Copies of the bulletin are available on request.

Valves

A new four-page, illustrated bulletin, No. 16-B, contains complete dimension tables for butterfly valves, 15 to 125 psi. It features valves for regulation and shut-off duty for air, gas, steam, liquids and semi-solids—both manual and automatic control types. The bulletin is issued by *R-S Products Corp.*, Dept. OF, Wayne Junction, Philadelphia.

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Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. Great as this sum is, *it is not enough!* So turn-to today! Get this new *family income plan working!*

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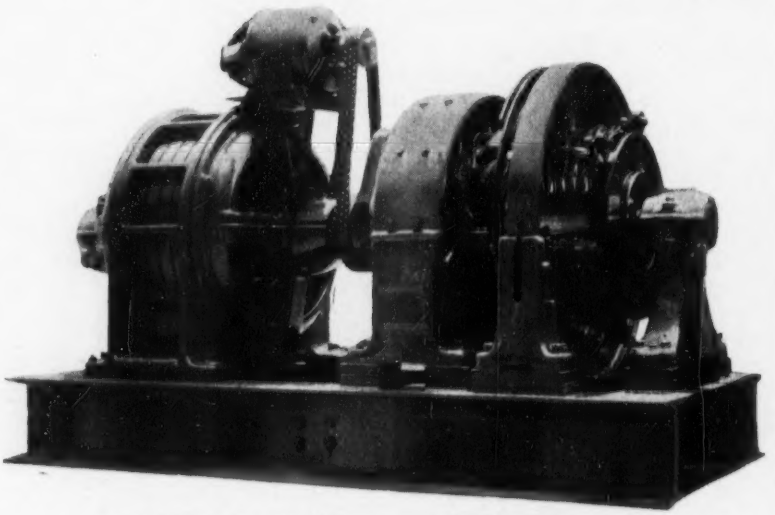

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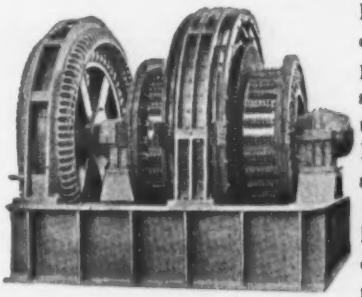

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This is the modern instrument used by industrial plants and laboratories to determine the corrosion resistance of plated, coated, lacquered or painted parts.

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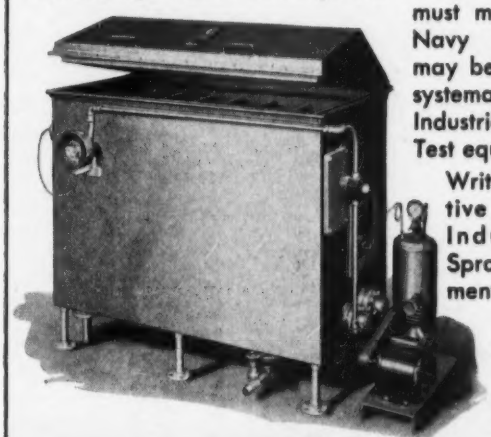

Write for descriptive bulletin on Industrial Salt Spray Test Equipment.

The U. S. Bureau of Standards recommends the Salt Spray test.

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« « ODDS and ENDS » »

As our own personal gesture to the National Metal Congress, we will confine this month's column to the subject of metals for a change.

Matrimonial Dep't:

In a news item entitled WEDDING RINGS SCARCE *The New York Times* made the following statement last month: *"Wedding rings are made of either gold or vanadium."* We knew that marriage was full of surprises but a *vanadium* wedding ring is something we will have to see with our own eyes before we believe it.

Hands-Across-the-Sea:

One of our English contemporaries, discussing the new United States five-cent piece, the "nickel-less nickel", devotes some little space to the characteristics which an alloy must have in order that it be suitable for this type of coin. The electrical resistivity and minimum density requirements, which are mentioned in the article, are very interesting, especially to operators of candy vending machines, etc., who use such characteristics to counteract the larceny in us by rejecting slugs, which are often employed in an effort to get something for nothing.

Of more interest to us was the statement near the bottom of the article to the effect that *"The metal must not be poisonous, so that children can swallow them freely."* We are quoting exactly, so help us!!

We have suspected for a long time that at least a few of our friends across the water had rather odd ideas of the importance of money to Americans. Is it possible that they think we feed our children money too?? Or that in chosing suitable alloys for coinage, *digestibility* is one of the factors considered?? What, oh what, have we done to deserve this??

Priorities Dep't:

In the new aluminum refining plants, 150 million dollars' worth of silver is being used for bus-bars, in order to save five million dollars' worth of copper. And one reason why there is practically no restriction on chromium for plating is that one ton of chromium will cover about one and one-quarter *acres* with a deposit 0.001" thick. This is the amount of chromium which goes into about 5½ tons of 18/8 stainless steel.

A zinc ore is considered to have a high cadmium content when 8 lb. of cadmium are present per ton, although some foreign ores carry as much as 12.6 lb. per ton. Since practically all of our cadmium comes from this source it can readily be understood why cadmium production cannot meet demand.

Post-Script:

Please don't write to tell us that palladium was meant in *The New York Times* news item at the top of this page.

THESE PLANES FLY SOONER

. . . . because the Bullard-Dunn Process Cleaning and Plating are done on the Same Conveyor

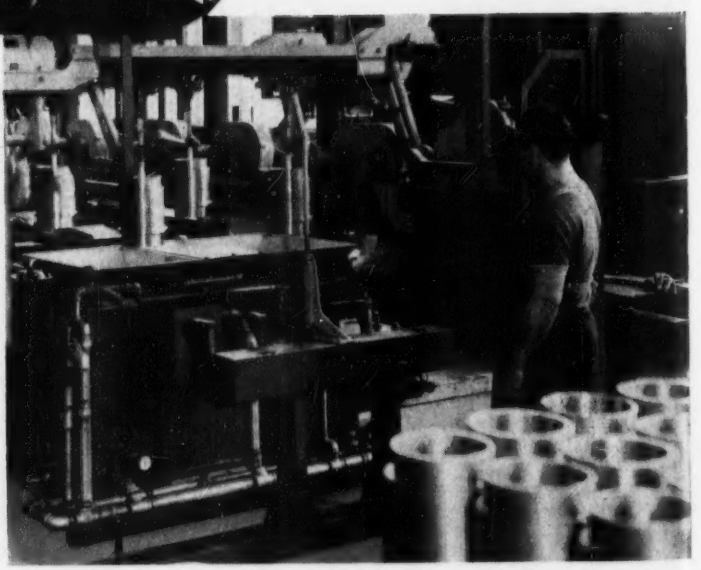
Official Photo, U. S. Army Air Corps

If there's a faster, more dependable method of descaling, you can count on the aviation industry to utilize it. One large airplane engine builder operates 8 manual and 8 automatic Bullard-Dunn units for cleaning prior to plating. (6 additional units are used for other important applications.) By using the same conveyor for both oxide removal and plating, the saving in time is obvious.

Equally important is the assurance of perfect preparation in order that the plated coatings will give maximum adherence and the best possible corrosion resistance.

Bullard-Dunn cleans out recesses as well as exposed surfaces, makes surfaces chemically clean, requires no hand wiping whatever and does not etch. It saves labor as well. These are some of the reasons why it is being employed to clean so many parts used in the aircraft industry. These include engine parts, propeller hubs, control bearings and many others.

Write today for descriptive booklet.



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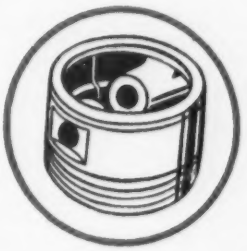
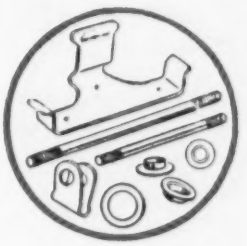
Remove inorganic dirts in less time at lower cost and be sure of a superior cleaning job by using MacDermid Inc. *special* compounds developed for all-out war production. You'll be amazed at the ease of electro-cleaning with the original ANODEX *reverse current* PROCESS when used with ANODEX high *current density* COMPOUNDS . . . METEX COMPOUNDS for cleaning aluminum, copper, and alloys will save you time and money as they are formulated for specific problems . . . METALEX COMPOUNDS for use in tumbling barrels and rotary washers clean small articles in less time and at decided savings. Write, today, for additional information.





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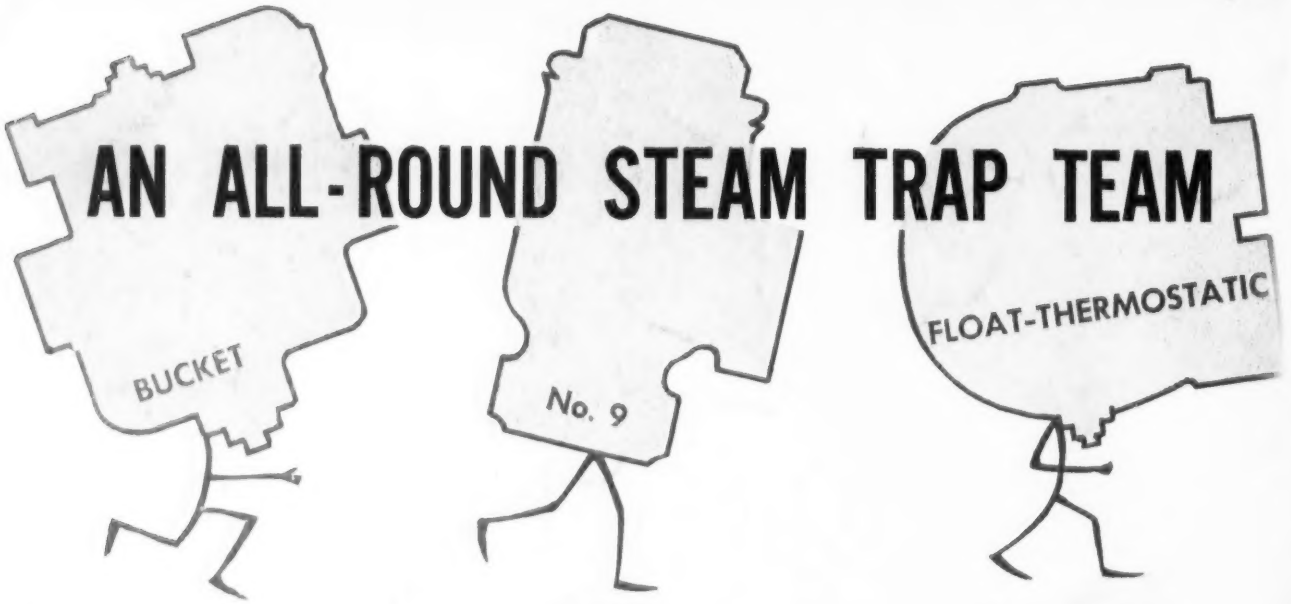


Sprinter *Miler* *Cross Country*

FOR THE STREAMLINED PRODUCTION RACE

The coach of a track team never would send in a "miler" to do a "sprint". And you wouldn't expect four men who never met before to win a relay race.

Are you using the same good judgment with regard to steam traps in your plant? Just because one type of trap works well in one or two spots is no reason to standardize on that type for every job in the plant.

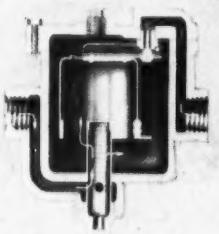
There are as many types of Sarco steam traps as there are runners in an outdoor meet. They are just as different. But all are aces in their own class and they know how to work together in the relay race where you use steam traps and temperature control. For instance —

The Sarco Bucket Trap is the sprinter — can speed up to take any load and is a bear for punishment. Cat. No. 350.

The Sarco No. 9 — thermostatic steam trap is like the miler, it conserves energy — can sprint on occasion, and can work on all pressures within its range. Cat. No. 250.

The Sarco Float-thermostatic steam trap is like the cross-country runner — it's ideal for the steady pull and particularly when used in connection with Sarco temperature control. Cat. No. 450.

Sarco makes many types of simple self-operated regulators which work well with these traps. Get full information from the nearest Sarco representative, or write for Catalog No. 600.



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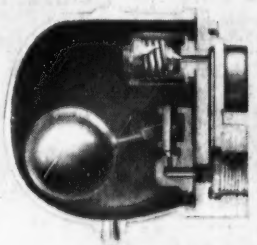
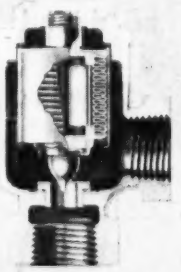


FLOAT-THERMOSTATIC



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